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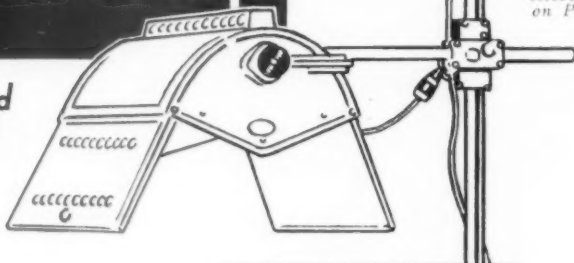
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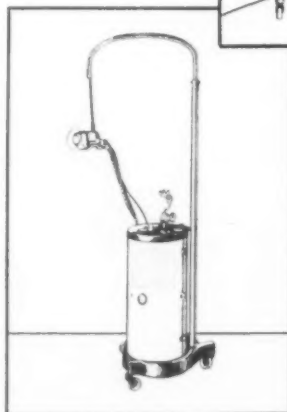
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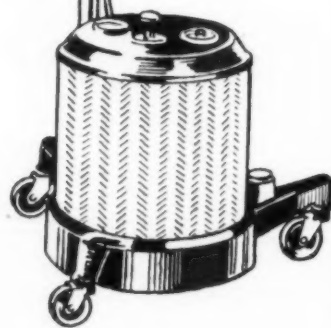
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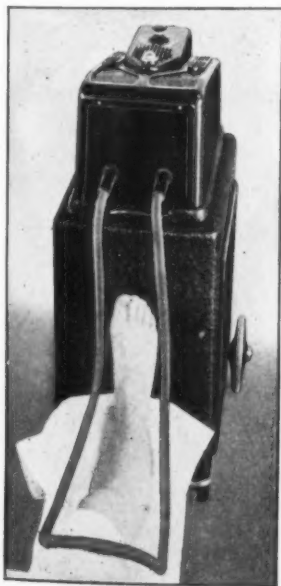
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"UNEMPLOYABILITY" A MEDICAL PROBLEM *

BERNARD FANTUS, M.S., M.D.

Professor of Therapeutics, College of Medicine University of Illinois;

Director of Therapeutics, Cook County Hospital.

Truth, even unpleasant, needs to be told. And it is my purpose to hold up for your contemplation a situation which while concerning the entire medical profession especially merits your earnest consideration. It is indisputable that many of the patients in need of physical therapy are in no economic position to secure it. The distressing part of this is, that the very ones who most often require therapeutic aid by physical agents belong to a social group which is least able to afford it. This circumstance in part explains why medicinal therapy is so much more employed than physical therapy. It hardly needs being told that the popularity of the former in comparison with the latter is due to its unquestioned lesser expense. Unfortunately medicines are not always effective and precisely in conditions that are amenable to physical measures.

Let us begin with the articulations. We have at our command measures capable of rendering supple diseased joints which without their timely and proper use will become stiffened and ankylosed. Likewise weakened muscles can be trained to perform useful labor, which without such a rational procedure are doomed to failure. It is common experience that thousands upon thousands of individuals have been forced into the large army of the physically handicapped through the fact that the helpful hand of physical therapy has not been extended to them at the proper time.

In connection with this important problem, occupation therapy properly directed and in co-operation with physical therapy, could bring about great amelioration in countless of handicapped patients. Unfortunately this form of therapy is still in its infancy and is applied merely from the standpoint of a diversion or at best of a mere exercise. This is apparent from the useless boxes and baskets, toys and trinkets turned out in the average occupational

therapy shop. It is, indeed, a tenet of occupation therapy, as practiced at present, that the utility of the article produced need not be considered. Without wishing to underestimate its great therapeutic value, I believe that what occupation therapy needs is to become *work therapy*. When we have added to its present program, vocational rehabilitation, actual training for a trade, and sheltered employment that will furnish remunerative occupation to the temporarily or chronically or incurably sick and disabled, then and then only will occupation therapy have acquired full adult dignity. Work therapy, I submit, is the cure for "unemployability."

It is a fundamental axiom that human health and happiness require a harmonious balance of work and of rest, of food and of fun; and, this is just as true of the sick as of the well. There can be no doubt that work, properly prescribed and fitted to the disabled individual, is an even greater remedy than rest. For rest, unduly continued, weakens; work, properly graded, strengthens. Rest soon becomes intolerably bore-some; and, because of this, is often abandoned prematurely. Work, properly prescribed, is an essential corrective to the evil tendencies and effects of rest. Rest treatment should merely be a preliminary to the more important portion of therapy: the re-fitting of the individual for work and for life.

Up to the present, the medical profession has not measured up to the responsibility of returning to employability those who, for physical or psychic reasons, have become unemployable. The physician generally considers his work done and discharges his patients or is discharged by them as soon as, or soon after, they get out of bed, out of a splint, or no longer require other rest-compelling form of treatment. That is one reason I say "unemployability is a medical responsibility."

Readjustment of the still handicapped person to the demands of life — no more

* Read at the Fourteenth Annual Session of the American Congress of Physical Therapy, Kansas City, Missouri, September 10, 1935.

insistent of which is the necessity of work — is left to the accidents of fate or to individual initiative: the former too prone to be whimsical and the latter too liable to be lacking to secure even tolerably good results. The shores of the stream of life are strewn with the flotsam and jetsam of disease, stranded, because the very ones who could clear this wreckage — the physicians — are not called upon to do so.

The gospel of the curative power of work is all the more necessary in these days when the deteriorating effect of unemployment on millions of our fellow citizens is daily becoming more evident; for there is as inevitable a tendency for the unemployed to become unemployable, as there is for the "unemployable" to become unemployed.

Recently, in a great city, many thousands of the destitute applying for work relief under the Civic Works Administration were given a medical examination. As a result of this examination, it was found that over 18 per cent of the applicants were "unemployable." This means that unless some method be found of taking care of this army of "unemployables," these persons will have to remain on a "dole" for an indefinite length of time, possibly for the rest of their natural existence, a burden to themselves, their families, and the state. It should be noted that these persons thus found unemployable had actually applied for work and that the percentage of the destitute who could be rescued by work therapy would be much greater if it included also those who consider themselves unemployable.

Henry H. Kessler,⁽¹⁾ as a result of a survey, estimates the number of crippled children in the United States at about half a million, and the number of crippled adults at another half a million. This means that about one million in the United States are in need of work therapy.

To point out, in detail, the methods that should be pursued to salvage this human wreckage, is beyond the scope of this discussion. It must suffice here to say that Kessler arrives at the conclusion, as a result of a review of existing legislation in the United States, that "potentially all the needs of the crippled and disabled can be met without resort to revolutionary changes in our social philosophy."

The "Wards of the State" are now taken

care of as a matter of course. We need to include the "Wards of State" among the destitute disabled. These have, in the past, been largely and most inadequately handled as objects of charity. What these people need is humane consideration and scientific rehabilitation. They need work therapy until they are no longer wards of the state. Industry should bear a large share of this expense; and the automobile industry most especially. It is, however, not only the automobile, but all industry that is today still largely a "hit-and-run driver."

It should become a fundamental axiom that, completely prostrating conditions excepted, every sick or disabled person is able to work and is the better for work, providing the work is suitable for each individual. There is, indeed, really no such thing as an "unemployable" person in the commonly used sense of the word (Bickham⁽²⁾).

The gospel that there are no unemployables also wipes out malingering, that bane of sickness insurance. Granted that a certain accident or disease has made a person unsuitable for his former occupation, work therapy would immediately find a substitute occupation for him.

While, in the days of prosperity, physicians often enough had to remedy the ill-effects of overwork, in these days of depression they are called upon still more frequently to remedy the evil effects of unemployment with all its consequences of anxiety, sleeplessness, pessimism, and the exaggerated appreciation of the minor maladjustments of the bodily machine. When a physician recognizes that unemployment is the fundamental cause of a patient's illness, what prescription can he formulate? How hollow sounds, these days, the advice to an ailing person: "Above all you need work"; when even willing, healthy men and women cannot find work. Who would, under such circumstances, employ anyone who is handicapped? We have a superabundance of drug stores, but no "work stores." To provide employment for the handicapped is the single most important problem of medical effort of today.

The unfortunate feature of it all is that those most in need of work therapy are least able to pay for it and that without governmental subsidy work therapy must

remain a mere idle dream or a pious wish. There is, however, a rainbow of hope in the sky. The establishment of the Social Security Act, just passed by the National Legislature and signed by our President, furnishes the basis for a reasonable hope that work therapy may become a realizable factor in the near future. It is true that at present, as the plans are revealed to us, nothing is said about this very matter of work therapy. It is planned that a great deal be done to rehabilitate handicapped children. We, of course, are agreed that it is impossible to do too much in that direction. But from a social standpoint the salvaging of the "unemployable" adult and rendering him employable is an even greater necessity. The child is merely one dependent; the disabled adult generally has several dependents who, through his condition, are thrown into dire need. Let us do all that is required to train handicapped children to the joy of useful work; but let us do at least as much for the disabled adult. By remedying this kind of "unemployability," largely wiping out the need for charity, we would strike at the very root of poverty, delinquency, and crime.

I appeal to you to become social missionaries, to go out through the length and breadth of this land and preach the gospel of work therapy. I charge you to assume responsibility for unemployability and to

place the further responsibility on whom it properly belongs — the State. We are, of course, all opposed to state medicine, yet we cannot help deploring the state of medicine. We are all agreed that health is more important than wealth; and yet we permit ignorant politicians, lawyers and business men to run our public affairs while we, doctors of medicine, the very ones who know most about human needs and nature, sit by and say and do nothing. Medicine has it in its power to largely abolish human misery.

Let us make this fourteenth session of the Congress of Physical Therapy an historic occasion by going on record that we recognize "unemployability" to be a medical responsibility and urge the speedy establishment of therapeutic work relief stations all over this great land. The curse of work relief and the "dole" — let us hope — will soon be a thing of the past. Therapeutic work relief is not only a necessity of the present, but will be a blessing for all future.

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1. Kessler, Henry H.: *The Crippled and Disabled. Rehabilitation of the Physically Handicapped in the United States.* New York, Columbia University Press, 1935.
2. Bickham, M. H.: *Employability of People on Relief, Rehabilitation, Rev. 9:3 (March-April) 1935.*



FEVER THERAPY IN PELVIC CONDITIONS *

Results of Experimental and Clinical Studies

WILLIAM BIERMAN, M.D.; E. A. HOROWITZ, M.D., and C. L. LEVENSON, M.D.

NEW YORK

The temperature to which the organs of the pelvis may be elevated becomes a matter of practical consideration when we attempt to rid them of a gonococcal invader. Gonorrhea is very prevalent and has plagued mankind for many generations. There are references to it in the Bible and in the writings of ancient China. A disease so old and so common has challenged the ingenuity of man in efforts to rid himself of this affliction. Many remedies have been advocated, but as yet none has been definitely established as having a high degree of merit. We are still searching for the *magna sterilizatio*.

The gonococcus has two interesting characteristics: the first is that it has adapted itself to grow in one species of animal only — *homo sapiens* — and the second, that it may be killed at temperatures which are comparatively uninjurious to the protoplasm of human cells. This latter fact offers a possible approach for therapeutic attack upon the germ. As with other thermal reactions, time is of as great importance as the degree of temperature elevation. The time-temperature relation necessary to kill the organism has been investigated by a number of workers. Possibly the best recent work in this research is that by Carpenter, Boak, and Warren⁽¹⁾ and their coworkers at the University of Rochester. They found numerous strains of the organisms which they isolated from their patients. Most of their investigations have been carried out at a temperature of 41.5 degrees C. (106.7 degrees F.) because that is usually considered the upper limit to which the systemic temperature of the human body may be raised and at which it may be maintained with a fair degree of safety. At this temperature elevation, the Rochester investigators found that the various strains survived for a period of from six to twenty-seven hours. On a basis of

the definite data obtained by these studies *in vitro* with reference to the organism inhabiting a given patient, the bacteriologist could write a definite prescription as to the time and temperature required. The physician, on following this prescription found that he could accomplish his objective: the destruction of the germs in his patient.

It is recognized that there are factors other than the direct thermolethal one responsible for the killing of the organism. These factors include changes in local and general immunity, increase in the number of leucocytes and in their phagocytic activity, acceleration of the blood flow, and the like. However, the exact influence of these other factors in achieving the lethal effect upon the gonococcus is not known. The one factor upon which we can definitely base our therapeutic reasoning is the physical one of the direct influence of heat upon the gonococcus. At temperatures higher than those which Carpenter and his coworkers have reported, the time required to kill the organism is lessened. Thus Boerner and Santos⁽²⁾ found that gonococci could be destroyed at 44 degrees C. (111.2 degrees F.) in one-half the time required at 42 degrees C.

The technic described by Warren and Carpenter, namely, the maintenance of a temperature at 41.5 degrees C. for a length of time indicated by the bacteriologic studies made on organisms isolated from the patient, is an excellent one. For routine clinical use it has two disadvantages: first, the fact that the required bacteriologic procedure is a rather arduous and comparatively complicated one with which very few institutions can cope; second, to maintain a systemic temperature at 41.5 degrees C. for periods longer than seven or eight hours is extremely trying to both patient and attendants.

We consider that it would possibly be more practical to administer as much heat as the tissues could safely withstand in the

* Read at the Fourteenth Annual Session of the American Congress of Physical Therapy, Kansas City, Missouri, September 11, 1935.

region where the organisms exist. The germs are, as a rule, localized in the genitourinary organs of the pelvis. Our problem was to discover how much heat these tissues could tolerate before they became destroyed, and how best to create such a degree of temperature elevation.

Pelvic Temperature Tolerance

Our work has been done mainly in the human female. We found that gross evidence of coagulation of the vaginal mucosa occurs if we produced a temperature of 113 degrees F. and maintained it for fifteen minutes. A temperature of 112 degrees F. for a period longer than three and one-half hours likewise caused destruction. The heat tolerance of human tissue has been determined by several workers. Kolmer and Liebesny⁽³⁾ found that the diathermic coagulation of the scrotum of dogs did not occur below 113 degrees F. Kyaw⁽⁴⁾ demonstrated by the application of diathermy that 112 degrees F. was the highest temperature tolerated by the human urethra without necrosis. Lavake⁽⁵⁾ found that 113 degrees F. developed in the cervix by diathermy was the highest temperature that did not cause a slough. Roblee and Royston⁽⁶⁾ stated that the threshold of living cell tolerance to heat is slightly over 112 degrees F.

We gave some thought to the methods available for the creation of heat in the pelvis. If all of the organisms were on the surface of the tissues, some method of conductive heating would work well. We were aware, of course, that this is not the case; that the germs do live beneath the surface. We know that in the female they might extend through the cavity of the uterus and cause inflammatory changes in the fallopian tubes. In the male they might pass through the prostatic ducts and also through the vas into the epididymis. Realizing the limitations of conductive heating, we appreciated the necessity for some form of convective heating. That heating by conduction does raise the temperature of tissues for some little distance away from the heating source was indicated by our experiments with the instrument developed by Elliott. This is essentially a vaginal hot water bag inside of which the water may be maintained at a temperature of 130 degrees F. It was obvious from the results of our work and of

other investigators, which we have previously described, that if a temperature approaching 130 degrees F. were developed within the mucous membrane touching the bag, coagulation would follow. The very fact that coagulation did not occur regularly, indicated that no such temperatures were produced within the tissue. We did find by means of a mercury thermometer introduced several inches beyond the female urethral meatus that temperatures between 103 and 105.8 degrees F. were produced in the bladder. Examination of the temperatures of the urine before and after thirty-five applications of the Elliott treatment indicated very little heating of this fluid. Conductive heating has also been produced by means of sounds introduced into the urethra and into the cervix. Guttman⁽⁷⁾ described such instruments heated electrically to a temperature of 130 degrees F.

The best form of convective heating which has been available until recent years is diathermy. Cumberbatch and Robinson⁽⁸⁾ used this form of heating by means of metallic rods which they inserted into the urethra and into the cervix. By this means a temperature of 114 degrees F. was developed within the tissues in contact with the active electrodes and maintained for ten minutes. While such a temperature should prove lethal to the gonococci lying within the heated tissues it is a question whether the thermal influence of this technic is sufficient to kill the germs lying in tissues beyond its reach. Corbus and O'Connor⁽⁹⁾ advised a similar technic in the treatment of the urethra in the female. Duncan,⁽¹⁰⁾ using a small Chapman vaginal electrode equipped with a thermometer, applied vaginal temperatures up to 110 degrees F. for thirty to forty-five minutes each day. Two European workers have reported cures of female gonorrhea following a single prolonged vaginal diathermy treatment. Kyaw⁽¹¹⁾ applied vaginal diathermy at least three or four hours continuously, sometimes giving a total of nine hours of treatment in a single day. Temperatures between 106 and 109.4 degrees F. were maintained in the vagina. Van Putte⁽¹²⁾ administered vaginal diathermy treatments of five hours' duration, developing a temperature of 104 degrees F. in the vagina.

In an effort to determine the actual temperatures in various tissues of the female pelvis during vaginal diathermy, we made two hundred and fifty-five observations.⁽¹³⁾ Thermometers were inserted into the urethra, bladder, cervix and rectum. The temperature of the bladder urine was determined before and after treatments. The temperature of the tissues of the cervix was measured by thermocouples. The current strength as measured by the hot wire milliamperemeter varied between 2,000 and 2,500 ma. The vaginal temperatures were determined by a thermometer inserted within the electrode. The average maximum temperature was 108.8 degrees F. nineteen minutes after the beginning of the treatment. At the end of the treatment, usually after about forty-five minutes, the vaginal temperature averaged 107.5 degrees F. The highest vaginal temperature registered during any treatment was 112.5 degrees F. Throughout each treatment observations were made every five minutes of the temperatures registered by the vaginal electrode thermometer and by thermometers placed in the adjacent cavities. The highest rectal temperatures were recorded at a distance between three and five inches from the anal orifice. Below three inches and above five inches the rectal temperatures were lower. The average rectal temperature closely followed the average vaginal temperature, attaining its maximum at almost the same time, but remaining 1.5 degrees F. lower throughout.

The temperatures registered within the bladder increased with the depth to which the thermometer was inserted. Three and four inches from the urethral meatus the average maximal bladder temperatures were within one-half degree of the average maximal vaginal temperatures, but were attained six to thirteen minutes later. These deep bladder temperatures were better sustained than the vaginal or rectal ones. At the end of treatment, the average bladder temperature had dropped but three-tenths of a degree from its maximum and was actually higher than the average terminal vaginal temperature.

The urethral temperatures averaged about three degrees lower than the deep bladder temperatures. To determine the temperature of the urine we had our patient

void into a paper cup. The average urine temperature before treatment was 98.4 degrees F. The temperature of the urine voided within a few minutes after the termination of treatment averaged 105 degrees F. Since the determinations by this method proved to be about one degree lower than their true values, the temperature of these urines actually averaged about 106 degrees F. In a few cases the urine was drained directly into a thermos bottle by means of a catheter, both implements having been previously heated to 100 degrees F. Urine temperatures of 107 degrees F. and above were several times recorded by this technic.

The temperatures in the cervical canal as determined by a mercury thermometer, the entire bulb of which lay within the canal, closely followed the vaginal temperatures, averaging about one degree lower.

To determine the temperature of the cervical tissues, thermocouple needles were inserted into various parts of the cervix. The temperatures recorded were usually within one degree or one and one-half degrees F. of the vaginal temperatures.

In 81 per cent of the determinations an elevation of mouth temperature was observed. This elevation varied between 0.1 and 2.4 degrees F., averaging 0.7. In a similar percentage of determinations (80 per cent) there occurred an elevation of the pulse rate, varying between two and thirty-four beats and averaging twelve beats per minute. In most instances the elevation of the pulse was accomplished by an elevation of mouth temperature.

Because the technic is occasionally advised, we made observations of temperatures produced in the pelvis during the transpelvic diathermy, using large anterior and posterior plates. The highest internal temperatures which we observed with this technic were: rectal 103.2, vaginal 102.2, bladder 101.9 degrees F. A posterior plate 15x9 and an anterior plate 9x9½ were used. The treatment lasted forty-five minutes and the maximal current was 2,000 ma. The patient was uncomfortable during the latter part of the treatment because of excessive heating under the plates. An elevation of 1.2 degrees F. mouth temperature followed this treatment. During eight other treatments with large anterior and posterior plate electrodes, the milliamperage aver-

aged 1,500. The maximal rectal temperatures varied between 99.6 and 101 degrees F., the vaginal between 99.5 and 100.5 degrees F., and the bladder between 99.8 and 100.5 degrees F. The cervical temperature never exceeded 99.9 degrees F. The temperatures mentioned were the maximal during the individual treatments. They were attained toward the end of the treatment. The temperature of the urine voided after these treatments showed no appreciable elevation.

The region most heated by diathermy with external plate electrodes appeared to be under the pubic margin of the abdominal plate. We have occasionally observed coagulation of the suprapubic fat. We have noted temperatures of 109 degrees F. as registered by a thermometer under the abdominal plate at the region nearest the os pubis. It is interesting to observe that the temperature under the abdominal plate electrode when plotted on a chart showed the same characteristic drop after the initial maximal temperature was attained as the temperature curve obtained with the vaginal electrode technic. From these studies it would appear that heating of the pelvic tissues by means of transpelvic diathermy is relatively inadequate.

Systemic and Local Elevation of Temperature

As the body is normally intolerant of any localized temperature elevation and attempts to cool the concerned area by its thermoregulatory mechanism — vasodilatation, sweating, etc. — we decided five years ago to combine the elevation of systemic temperature with local pelvic heating. We attempted to do this first by means of short-wave current. The apparatus was a 1,000 watt oscillator operating on a frequency of 10 million cycles per second with a wavelength corresponding to 30 meters. This instrument we called the radiotherm.

In order to produce a simultaneous increase of body temperature with a still higher increase in the temperature of the vagina we employed the following method: With the patient between the condenser plates of the radiotherm, an electrode is inserted into the vagina. This electrode is connected, through an ammeter, to a small auxiliary metal plate suspended near one of the large condenser plates of the radiotherm.

Under these conditions the electrical field produced in the region between the electrode and the condenser plate opposite to the one near which the auxiliary plate is suspended, is considerably higher than at any other part of the body. When the region to be heated is located asymmetrically in the body of the patient, the pick-up plate is brought near the condenser plate opposite to the affected side. If the region is centrally located in the body the pick-up plate is shifted from one side to the other. With a pick-up plate of about 300 sq. cm. area, the distance between the pick-up and the condenser varies from 10 to 30 cm. The readings on the radio-frequency ammeter usually vary from about one to two amperes.

By these means the average result in fifty instances was an elevation of the temperature in the vagina to 42.5 degrees C. (108.5 degrees F.) during an average time period of fifty-three minutes. This temperature was determined by a mercury thermometer inserted in the vaginal electrode. Coincidentally, the average rectal temperature rose to 40.5 degrees C., an increase of about 3.5 degrees C., while the average temperature in the mouth rose to 39 degrees C., a rise of about 2 degrees C. The rectal and mouth temperature were also taken by means of mercury thermometers. All temperature readings were made while the current flow was discontinued.

The operation of the electric circuit may be explained as follows: The radio frequency potential of the electrode is raised to a value between the ground and that of the condenser plate adjacent to which a pick-up plate is suspended. Normally, the center of the body is at ground potential, hence, in this case, there must be a larger potential gradient from the electrode to the other condenser plate than would normally obtain in this region. Because of the small change in capacity of the system, a change in wavelength was anticipated. Measurements of the wavelength show that this change is of the order of one-half meter.

Although we did not maintain the differentially increased pelvic temperatures for periods longer than about one hour, we actually secured some good clinical results in the treatment of gonorrhea⁽¹⁴⁾ in the female.

We used the radiotherm and more re-

cently hot water baths to produce initial elevation of systemic temperature. In order to maintain the elevated temperature, we transferred our patient to a bed where she was surrounded by a hood covering the entire body with the exception of the head. The hood was heated by electric lamps. We attempted to apply additional pelvic heating by diathermy while the patient lay within the hood. We used a vaginal electrode and a suprapubic one. With this technique, the necessary current sometimes caused painful induration in the fatty tissues of the pubic region. We therefore abandoned this method, until we determined to increase the area of the dispersive electrode. The employment of two large plates, one on the abdomen and the other under the back, as dispersive electrodes, was not always sufficient to prevent injury to the subcutaneous fat. We found it desirable to add two other plates about three inches wide and five inches long, to the outer aspect of each thigh. These four dispersive plates were connected together to one terminal of the diathermy apparatus while the vaginal electrode was connected to the other terminal. We have also found the cuff electrode technique to be a good one. One large cuff encircles the abdomen, two other cuffs are placed around the thighs. These three cuffs are connected to one terminal of the apparatus.

We ordinarily employed from 1,800 to 3,000 milliamperes of current as indicated by the hot wire meter. The current strength was varied to produce the desired changes in the vaginal temperature. We found that a vaginal temperature of about 111 degrees F. (as indicated by the thermometer in the vaginal electrode) might ordinarily be maintained for a period of three and one-half hours without causing tissue damage. We have patterned a special vaginal electrode after casts made of the vaginal cavity.

To permit a prolongation of pelvic heating and to reach tissues beyond the posterior fornix, we inserted a large electrode into the rectum and maintained it there for a period of about one and one-half hours.

The anatomic structure in the male did not present a cavity into which a large metal electrode could be inserted in close proximity to the genital foci of infection. It was found necessary to utilize the rec-

tum for this purpose. To prevent overheating of the rectal mucosa while attempting to achieve a maximum heat influence upon the posterior urethra, prostate, and seminal vesicles, the metal electrode was water cooled. By this means the involved tissues at a distance were heated conversively, while the rectal mucosa was protected by the conductive influence of the water. This cooling arrangement was necessary because the rectal electrode in the male was kept in place for from three to four hours. The milliamperage was about 1,500.

By controlling the lights in the hood and the amount of diathermy current the systemic temperature could be varied. The mouth temperature which was usually 0.7 degrees F. below the rectal temperature was used as an index of systemic elevation. The systemic elevation was maintained for five to six hours at about 105.5 degrees F. by mouth.

By this procedure it appeared possible to cause rapid improvement in the posterior urethra, the prostate and the seminal vesicles in the male. The second glass of the two glass urine test became clear.

In the female, the results in general were very satisfactory. We have treated 52 women for gonorrhea whose subsequent course we have been able to follow. In every case the diagnosis of gonorrhea had been established by the finding of typical Gram-negative intracellular diplococci in the secretions of the cervix and, in some of the cases, also of the urethra. More recently we have also been using cultural methods for the demonstration of the organism. In 45 of the 52 patients the cervix and urethra were freed of gonococci after an average of 2.4 treatments. Fifteen of the 45 patients required but a single treatment. Three of the cases received one, two and three treatments, respectively, following which the cervix was free of gonococci, but not the urethra. This may have been due to the shortness of the vaginal electrodes we were using at that time. The short electrodes failed to include the urethra in the field of high local temperature elevation in patients with deep vaginas. In each of these three cases, instead of again subjecting the patients to fever treatment, we coagulated the Skene's ducts after which the gonococci could no longer be found. The four re-

maining patients — one treated once and three treated three times — were not yet freed of gonococci when they discontinued treatment. All of our patients were kept under observation with frequent bacteriological examinations of the secretions.

Of the 52 cases, 26 were complicated by gonorrheal salpingitis in the subacute or chronic stage. In every instance the treatment was followed by rapid subsidence of the tubal inflammation. Pain disappeared, the adnexal masses became rapidly smaller and the uterus regained its mobility. In six of the cases, however, a palpable enlargement of the adnexa persisted.

While the technic of the application of pelvic heat by means of combined general and additional local temperature elevation is not ideal, we believe that this procedure offers the best possibility of ridding the human host of his or her gonococcal invader.

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PHYSICAL TREATMENT IN POSTURAL DEFECTS *

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Mechanotherapy in the form of exercise for mechanical defects of the body dates back to the second century. Galen at that period said concerning these conditions: "It should be kept in mind that exercise strengthens and inactivity wastes." On the island of Cos where orthopedic cases were given hygienic, hydro- and heliotherapeutic treatments, Hippocrates (460 B. C.) observed clinically the effect of

postural attitudes on the bodies of children and adolescents. He postulated from this the etiology of so-called functional scoliosis. These ancient teachings seem to have faded from history only to reappear as a new contribution by modern orthopedists. In the seventeenth century Paré reiterated and confirmed the theory of Hippocrates.

In the eighteenth century André, who originated the term "orthopedic," decided that muscle balance was responsible for symmetry, and asymmetry was due to postural faults

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during formative years of life. His contemporary, Ludwig, said: "The habit of tilting the body in the 'fatigue position' so common among growing children is the cause of permanent structural deformity." André devised a system of postural training which included methods of prevention and correction. Those of prevention are applicable for the child of today and consist of the study and regulation of the sitting habits and chairs of children, the height of the table and the position taken while studying, with regular, diversified exercise. The curative methods include graded exercise, rest, and supportive apparatus.

In the nineteenth century Delpéch used graded exercises for correcting scoliosis and for strengthening muscles of the trunk by posture training, and Champonière, who did much original work with fractures and mechanotherapy, was most enthusiastic about the use of massage and active motion in all cases where reactivation of muscles was necessary.

Early in this century Goldthwait showed the anatomic relation between poor posture and organic displacement and dysfunction. In 1926, Magnus conducted extensive researches into the subject of postural reflexes and demonstrated the underlying involuntary control of posture in normal individuals. He said, "posture is an active process and is the result of the cooperation of a great number of reflexes, many of which have a tonic character. The attitudinal as well as the righting reactions are involuntary." The conditioning of reflexes is done through repeated voluntary movements through the use of the central nervous system and the neuro-muscular apparatus. Back in the eighteenth century Ling, the Swedish gymnast, believed that education of the locomotor system was the best way to prevent poor posture, and upon these ideas the present Swedish school of physical therapy is founded.

Of course, the prevention of poor posture in children is the ideal, but until this is more commonly practiced than at present, there are many cases which must be corrected, and will respond to this historic type of treatment-exercise. An incentive must be found to suit the age of the child and, in the older child, to suit the sex. The small child can be reached through play interests and through imitation, while the larger boy is approached

through his interest in athletics and the girl through hers in esthetics.

Methods of recording postures are necessary and photographs are valuable. Silhouettes taken directly on sensitized paper are deceptive because of the projection of the scapulae and elbows beyond the line of the spine, unless this is located by pointers of known length as in some prints. A combination of silhouette and photograph will record the lateral defects and has the advantage of being quite inexpensive. Postures in action may be recorded by the movie camera but this is so expensive that it is done only occasionally.

Presentation of Cases

CASE 1. Gates — 4 years old. Pronation. Exercise of walking on the outer borders of the feet with toes flexed and foot inverted and strongly supinated. Muscles used — tibialis anterior and toe flexors. This is one of the easiest exercises for little children to learn, but usually an object must be carried under the first toe in order to prevent the toe extensors from working. This child has improved greatly in the three months he has been doing the exercises. He is showing habit formation because he unconsciously assumes the position of correction.

CASE 2. Lynn — 4 years old. Pes planus and pronation. The same exercise as in Case 1, but done by carrying marbles which she does easily, being able to run with them. Her shoes are raised along the inner borders and a small felt pad is inserted to hold up the inner border of the long arch. She is almost corrected and the next pair of shoes will be worn without the raising of the inner border.

CASE 3. Shelia — 5 years old. Genu valgum, pronation, and dorsal kyphosis with flat chest and protruding abdomen. First seen two years ago when she was brought because of frequent stumbling and falling. For the feet and knees the same exercise was given as in Cases 1 and 2. To stretch the outer lateral ligaments of the knees the cross-legged-tailor-sitting position was used and intermittent pressure applied to the inner aspect of the knees. For the chest and abdomen the child carried a bean bag on her sternum by thrusting her chest out in an exaggerated strut position, and soon learned to retract her abdomen when it was touched. Her general posture is good, but the knees need more correction, though she no longer stumbles.

CASE 4. Jean — 7 years old. Typical fatigue slump in child. Dorsal kyphosis and lumbar lordosis with prominent abdomen. Feet pronated and flat. Exercises: (1) Lying on back. Contract abdominal muscles and flatten lumbar region. Later retract abdomen and flatten lower back while standing with back against a wall. Eventually control the curve in the lumbar region while standing free from the wall and while walking. (2) Lie face down with the trunk on a table or bench, while the legs hang down at right angles to prevent hyperextension in the

lumbar region. Grasp a bar with the hands about shoulder-width apart. Pull the bar behind the shoulders and raise the shoulders and head with the chin close to the neck. The chest remains on the table or bench. Muscles used are the extensors of the upper back and neck. In this same fundamental position a swimming motion of the arms is used. (3) A combination of movements which use the shoulder retractors, upper back extensors and abdominal muscles is as follows: Supine lying; arms extended sideways in line with the shoulders, palms down. By pressing backward with the head and hands the upper back is arched so that the chest is very prominent. Then the abdominal muscles are used to lift the trunk, and the hip flexors assist to bring the body to a sitting position, while the hands continue to press against the floor as they are dragged in behind the trunk. The trunk is lowered backward in the same position of arched back. (4) The same marble exercise was used for the feet as in the previous cases, but as Jean was older, she also walked with toes turned in and elevated on a ridge-shaped board. She is better, but does not work consistently.

CASE 5. Frederick — 11 years old. Seen in September, 1934. High cervical lordosis and cervico-dorsal kyphosis, shoulders forward with tight pectoral muscles and lumbar lordosis with prominent abdomen. Stretching exercises were started immediately and increased in severity. Stretching: (1) Lie on the back with a rolled blanket under the kyphosed dorsal region. Extend the arms in line with the body beyond the head. The weight of the arms stretched the pectoral muscles and added to the stretch caused by the position in the anterior common ligament on the bodies of the vertebrae. A weight (sand bags) placed on the elbows increased the severity of this exercise. Later the arms were stretched and pressed down toward the table by an operator. Sitting on the floor with the legs straight forward. An operator grasps the upper arms and pulls up and back in line with the pectoral fibers while making counter pressure against the dorsal kyphosis with the knee. This stretch is held a few seconds, released and repeated. The slow, steady stretch is believed to avoid the production of a stretch reflex in the pectoral muscles. (2) Hanging by the hands from a bar placed near a wall. Later a pad was placed on the wall so that pressure was made against the kyphosed spine while the body weight stretched it. (3) Recently a combination exercise has been used to stretch the cervical region by suspending Fred in a Sayre head sling.

Corrective Exercises. For the shoulder retractors: (1) Swimming and bar pulling behind the shoulders as in Case 4. (2) Rowing movements with a home-type rowing machine. (3) Standing with back against the wall with the feet eighteen

inches from the wall, extend the body to a straight line between the feet and the back of the head which remains against the wall. This uses all the extensors on the back, but besides that it helps to adjust the neuro-muscular mechanism by the pressure on the back of the head while the cervical lordosis is somewhat corrected. (4) Sitting on the floor with the legs straight forward. This prevents an increase in the lumbar lordosis. Bar pulling behind the shoulders being careful not to move the head forward. Severity increased by resistance by an operator. For the abdomen and lower back: (1) Lying on the back with the abdominal retraction and flattening of the lumbar region to the table as in Case 4, with the addition of an attempt to flatten the cervical region to the floor, keeping the chin close to the neck. This is repeated while standing with the back to the wall. ((2) Raising the trunk to a sitting position. This uses the hip flexors as well as the abdominal muscles, so it is not emphasized. (3) On hands and knees. Tilt the pelvis forward and backward by contracting and relaxing the abdominal muscles. (4) Hanging by the hands. Raise the knees to the chest, extend the legs forward and lower slowly. This also involves the hip flexors but is in addition a valuable abdominal exercise.

It will be seen from these typical cases that the common postural defects in children are those of slump and relaxation: round shoulders and upper back, lumbar lordosis with prominent abdomen, faulty knee alignment and pronated and flat feet. Most of these carry over into adult life with an occasional shift in the tilt of the pelvis which accompanies the flattening of the lumbar curve in the adolescent.

In the healthy child the opportunity for such play activities as will employ all the muscles of the body is usually the only means necessary to prevent poor posture; this includes the muscles of the toes and the upper back and involves walking in soft soil barefooted and climbing and hanging with the hands. The play opportunities of our civilization do not offer these, so that the children sit and do small hand movements or running activities which use the large leg and lower back muscles. If the posture has become defective, the child must be stimulated to stress certain activities which will restore the muscle balance to the body. Well equipped play space should provide opportunities for normal, all-around development of the child's body.

PHYSIOLOGIC EFFECTS OF ACETYL-BETA-METHYL- CHOLINE CHLORIDE BY IONTOPHORESIS *

PRELIMINARY REPORT

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with the technical assistance of

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This preliminary report is a part of a general program to study the physiologic effects in animals produced by iontophoresis of acetyl-beta-methyl-choline chloride and related compounds. In recent years considerable data have accumulated regarding the pharmacologic actions of various choline compounds, but nowhere in these studies have we been able to find any reference to the administration in animals of acetyl-beta methyl-choline by iontophoresis.

Hunt and Taveau⁽¹⁾, the first to study choline and some of its compounds, showed the blood pressure reducing properties of acetyl choline and acetyl-beta-methyl-choline. Simonart⁽²⁾, in studies of a series of compounds of choline reported that acetyl-beta-methyl-choline and the ethyl ether of beta-methyl-choline offered possibility of the greatest clinical usefulness. Starr and his co-workers⁽³⁾ carrying this work further studied the action of these two compounds on the heart, blood vessels, gastrointestinal tract and bronchial muscles, and reported effects similar in many respects to parasympathetic stimulation. From a clinical standpoint, J. Kovács⁽⁴⁾ was the first to administer acetyl-beta-methyl-choline by iontophoresis for arthritis.

We have undertaken this experimental study on account of some very marked general reactions resulting from the routine clinical administration of acetyl-beta-methyl-choline chloride (Mecholyl-Merck) by iontophoresis in chronic arthritis. Since the

clinical objective of iontophoresis is to produce a controlled local action and since we have clinical evidence from our own observations that the action of the drug is not limited to the site of administration, we became interested in comparing the action of acetyl-beta-methyl-choline by iontophoresis on laboratory animals with results described by investigators using other methods of administration.

Procedure

Fifty-two experiments were performed on 18 dogs (4 females and 14 males) ranging in weight from 10 to 20 kilos, under morphine-urethane anesthesia (2 cc. of 50 per cent urethane solution per kilo intramuscularly and 0.4 cc. of 2 per cent morphine sulphate intramuscularly), enough time being allowed to elapse after induction of anesthesia (one hour or more) to permit stabilization of the circulation and respiration before the experiment was started. Carotid blood pressure, heart rate and respiratory rate (in most experiments) were recorded continuously on the kymograph.

To the unshaven thigh of the dog, a cellulose-cotton pad approximately $\frac{3}{4}$ inch in thickness and well soaked with about 200 cc. of an aqueous solution of either 0.2 or 0.5 per cent acetyl-beta-methyl-choline chloride (Mecholyl-Merck) was first wrapped snugly around the entire area of one thigh including the groin, then over this pad an electrode of block tin (40 to 45 sq. in.) was applied. Over this electrode an elastic Ace bandage was wrapped in order to keep the electrode and soaked pad closely and equally approximated to the skin at all points. The positive pole of a 45 volt B battery was then connected through several resistances and a milliamperere

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TABLE 1.—Change in Heart Rate

Dog	Kg. Wt.	Solid Electrode Sq. In.	Milli- amperage	% Solution	Before Current On	After Current On— 1 min.	2 min.	3 min.	4 min.	5 min.	Change in 5 min.	After Current On— 6 min.	7 min.	8 min.	9 min.	10 min.	Change in 10 min.
M-13	16	40-45	1	Saline Control	207	214	211	208	215	213	+ 6	.....	.....	.....	.....	.....	.....
M-11	12	40-45	20	"	146	144	140	144	143	145	— 1	.....	.....	.....	.....	.....	.....
M-13	16	40-45	50	"	228	229	227	228	233	233	+ 5	.....	.....	.....	.....	.....	.....
M-13	16	40-45	100	"	233	224	231	232	234	232	— 1	.....	.....	.....	.....	.....	.....
M-8	10	40-45	10	Mecholyl 1/2%	116	128	165	162	176	176	+60	.....	.....	.....	.....	.....	.....
M-4	11	40-45	10	1/2%	180	188	189	184	187	190	+10	.....	.....	.....	.....	.....	.....
M-12	12	40-45	10	1/2%	140	144	158	158	170	174	+34	171	157	160	165	164	+24
A-4	12	40-45	10	1/2%	122	138	175	226	228	224	+102	218	222	220	221	220	+98
M-10	11	40-45	20	1/2%	120	132	129	131	143	147	+27	151	151	132	166	163	+43
A-4	12	40-45	20	1/2%	180	172	185	220	236	233	+53	230	228	225	230	210	+30
K-1	13	40-45	20	1/2%	141	143	208	230	225	225	+116	.....	.....	.....	.....	.....	.....
M-13	16	40-45	30	1/2%	220	212	222	224	224	230	+10	232	241	244	.....	.....	+24***
A-6	13	40-45	40	1/2%	129	133	137	150	161	170	+41	170	167	163	165	168	+39
K-1	13	40-45	40	1/2%	154	174	238	.....	.....	.....	+74*	.....	.....	.....	.....	.....	.....
K-3	20	40-45	40	1/2%	189	180	199	206	200	198	+ 9	188	175	.....	.....	.....	—14**
M-10	11	40-45	45	1/2%	145	150	189	178	181	171	+26	166	174	170	169	173	+28
M-8	10	40-45	50	1/2%	130	154	182	206	203	203	+73	204	204	206	205	205	+75
M-4	11	40-45	50	1/2%	Unable to count from graph.												

* 2 minutes.
 ** 7 minutes.
 *** 8 minutes.

meter to the distal end of this electrode at the thigh region. The negative pad, which was slightly larger than the positive one, consisted of a large piece of block tin covered by several towels well soaked in a hypotonic saline solution. This was applied to the animal's back and connected by proper leads to the negative pole of the battery. The intensity of the current was advanced fairly rapidly to the desired potential. Currents varying from 10 to 50 milliamperes were used. In six experiments an attempt to determine the minimal effective dose to produce an appreciable fall in blood pressure was made. In these cases a 5 minute run of current was considered adequate to determine a positive or negative response.

Results

Our results show that physiologic effects similar to general stimulation of the parasympathetic system are obtainable by the iontophoresis of acetyl-beta-methyl-choline chloride into the unshaven thigh of the dog. Variable effects on the heart rate, a fall in blood pressure with increased depth of respiration, marked salivation and an occasional bloody defecation and forceful urination are the specific effects we have observed.

All of our experiments show a variable increase in heart rate ranging from 9 to 116 beats for five minutes duration of current (Table 1.) In three of these experiments there was an initial fall of about 9 beats within the first minute with current; however, the

following minute-intervals show varying increases in heart rate. The per minute change in rate fairly well parallels the fall in blood pressure in regard to the time of its occurrence, but not to the intensity of drop in pressure. In the majority of experiments acceleration in cardiac rate reaches its maximum in from one to three minutes before the maximum fall in blood pressure is reached (Fig. 1). These variable effects of acetyl-beta-methyl-choline chloride on the heart rate when administered by iontophoresis are probably explainable on the basis of the variability in the rate of diffusion of the drug into the tissues and the circulatory fluids, and the speed of reactivity of compensatory mechanisms influencing cardiac rate in the intact anesthetized dog.

A marked increase in salivation was noted in all experimental animals. Though no attempt was made to record salivary secretion from a cannulated salivary duct, quantities of from 30 to 125 cc. of clear and very viscid secretion were collected in a beaker at the mouth.

In current intensities of 10 to 50 milliamperes, we consistently observed a lowering of the blood pressure (10 to 65 mm.). In the majority of experiments, the rapidity in drop of pressure and the length of time it was maintained varied directly with the intensity of current (Table 2). From the start of current a slightly variable latent period of one to three minutes was noted before any perceptible effect on blood pressure was shown.

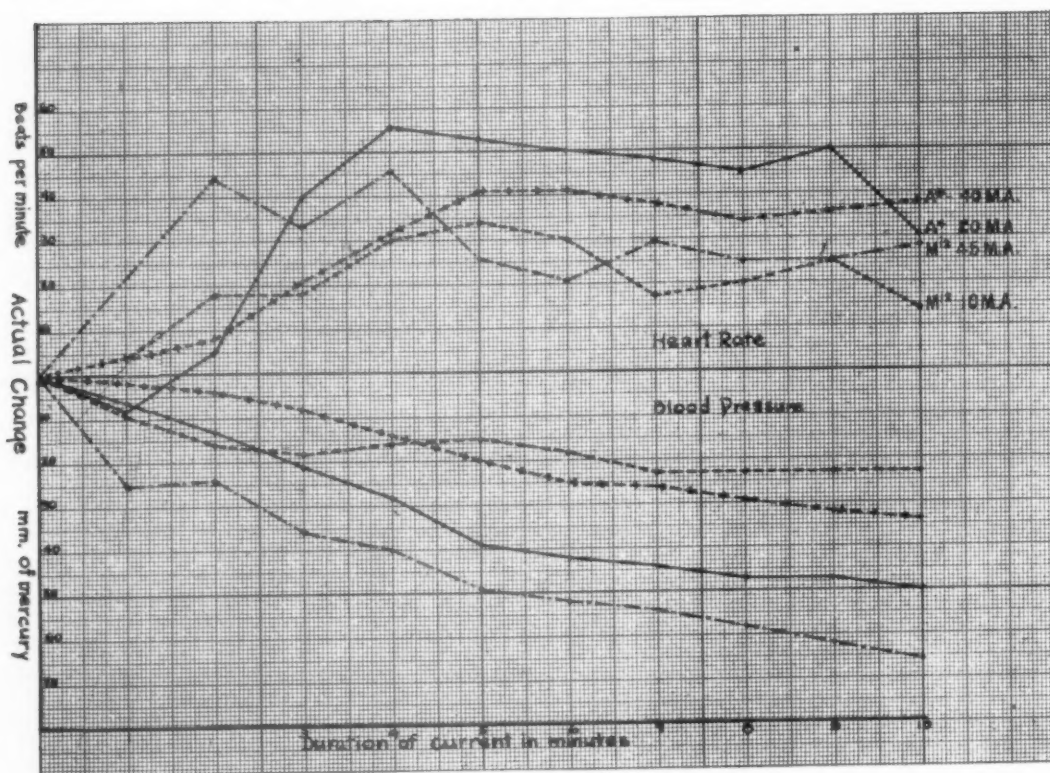


Fig. 1.—Change in heart rate and blood pressure with various amounts of current.

TABLE 2.—Changes in Blood Pressure

Dog	Kg. Wt.	Solid Electrode Sq. In.	Milli-ampere	% Solution	Before Current On	After Current On	1 min.	2 min.	3 min.	4 min.	5 min.	Change in 5 min.	After Current On	6 min.	7 min.	8 min.	9 min.	10 min.	Change in 10 min.
M-13	16	40-45	1	Saline Control	112	112	110	111	112	112	112	0	.....	.....	.....	.....	.....	.....	.....
M-11	12	40-45	20	"	86	86	86	86	87	86	86	0	.....	.....	.....	.....	.....	.....	.....
M-13	16	40-45	50	"	107	106	105	104	108	106	106	-1	.....	.....	.....	.....	.....	.....	.....
M-13	16	40-45	100	"	106	106	102	100	98	100	100	-6	.....	.....	.....	.....	.....	.....	.....
M-8	10	40-45	10	Mecholyl 1/2%	140	115	120	124	133	130	130	-10	.....	.....	.....	.....	.....	.....	.....
M-4	11	40-45	10	1/2%	94	85	82	84	80	76	76	-18	.....	.....	.....	.....	.....	.....	.....
M-12	12	40-45	10	1/2%	97	88	81	80	81	82	82	-15	79	78	74	74	74	74	-23
A-4	12	40-45	10	1/2%	118	116	102	83	78	73	73	-45	70	71	70	69	68	68	-53
M-10	11	40-45	20	1/2%	104	104	102	102	94	87	87	-17	84	82	80	78	77	77	-27
A-4	12	40-45	20	1/2%	100	94	87	79	72	61	61	-39	58	56	53	53	50	50	-50
K-1	13	40-45	20	1/2%	144	137	120	116	114	110	110	-34	82	80	80	.....	.....	.....	-14***
M-13	16	40-45	30	1/2%	94	92	89	86	86	84	84	-10	83	82	79	76	74	74	-34
A-6	13	40-45	40	1/2%	108	106	104	100	94	88	88	-20	.....	.....	.....	.....	.....	.....	.....
K-1	13	40-45	40	1/2%	160	154	122	.....	.....	.....	.....	-38*	.....	.....	.....	.....	.....	.....	.....
K-3	20	40-45	40	1/2%	135	135	102	84	75	70	70	-65	66	64	.....	.....	.....	.....	-71**
M-12	11	40-45	45	1/2%	102	77	78	66	60	53	49	-49	50	48	44	40	36	36	-66
M-8	10	40-45	50	1/2%	146	138	124	117	116	116	116	-30	115	111	111	115	113	113	-33
M-4	11	40-45	50	1/2%	86	75	42	34	32	32	32	-54	31	31	30	30	30	30	-56

* 2 minutes.

** 7 minutes.

*** 8 minutes.

With strong currents, 40 to 50 milliamperes (Figs. 5 and 6), the effects produced compare favorably with subcutaneous injections of acetyl-beta-methyl-choline chloride as shown by Starr⁽³⁾.

After determining the ionization factor of a 0.02 per cent solution of acetyl-beta-methyl-choline which was 84 per cent determined by the freezing point method, an attempt was made to find out which dilution of the drug is most efficient in producing demonstrable physiologic effects. Using dilutions ranging from 1-1000 to 1-8000 the results obtained showed very little change except with the dilution of 1-10,000 where a decided difference in blood pressure was observed (Table 3). Therefore, we are led to believe

that the different dilutions of this drug, within the limits investigated, do not change the physiologic effects observed when the drug is administered by iontophoresis.

In the final experiment of this series, we decided to reverse the poles, that is, to apply the negative pole to the pad soaked with acetyl-beta-methyl-choline chloride. Then after a run of ten minute with 40 milliamperes of current, we changed the poles to their original positions, using the same pad which was used with the reversed poles, with no appreciable lowering of blood pressure. However, when the positive pole was returned to the pad soaked with the acetyl-beta-methyl-choline a decided drop in blood pressure (27 mm. in 5 min.) was noted. The results obtained when

TABLE 3. — Change in Blood Pressure, Cardiac and Respiration Rates*

Time of Current	1-1000			1-2000			1-4000			1-8000			1-10,000		
	B.P.	H.R.	Resp.	B.P.	H.R.	Resp.	B.P.	H.R.	Resp.	B.P.	H.R.	Resp.	B.P.	H.R.	Resp.
0	138	200	45	154	98	82	124	142	36	124	144	19	140	108	76
1	139	203	45	149	100	82	124	145	36	124	160	19	136	108	63
2	138	220	45	138	120	87	112	150	34	122	160	20	136	114	74
3	94	218	43	114	126	91	110	158	31	104	195	26	133	139	84
4	86	224	45	111	138	90	96	166	28	100	200	25	130	140	80
5	88	220	47	92	162	98	84	170	26	90	208	23	127	151	80
6	98	226	48	92	172	112	80	178	24	83	200	26	122	152	80
7	86	230	50	88	194	122	74	185	24	73	198	28	120	181	81
8	82	232	50	87	200	128	70	190	24	73	200	34	118	189	84
9	80	234	54	84	208	136	69	198	25	73	203	38	112	190	80
10	79	240	54	82	210	140	69	214	24	70	200	40	112	180	75
Total Changes	-59	+40	+9	-52	+112	+58	-55	+72	+12	-54	+56	+21	-28	+72	-1

* (Dog A3, 13 kilos, plate electrode 40 square inches and 40 milliamperes current.)

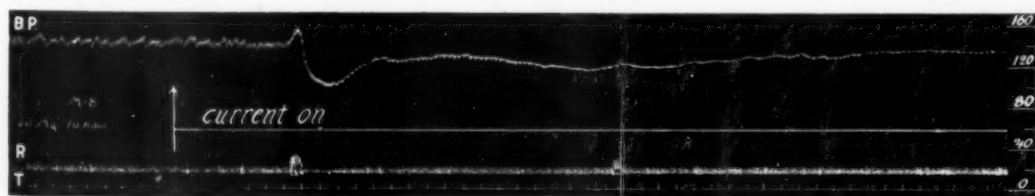


Fig. 2. — B.P.—mean arterial blood pressure; R—respirations; T—time in 6 sec. intervals; Scale at right—mm. Hg.; Female dog 10 kilos; 0.5 per cent acetyl-beta-methyl-choline chloride at positive electrode (45 sq. in.); 10 ma. current.

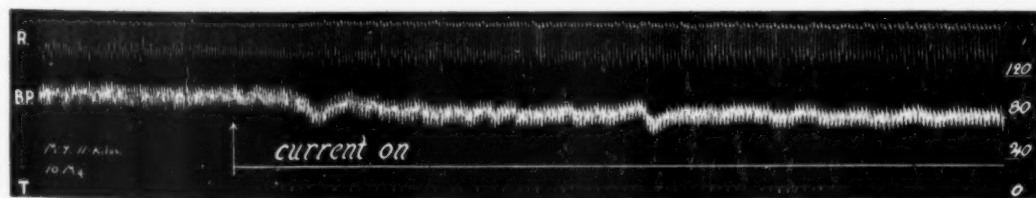


Fig. 3. — R—respirations; B.P.—mean arterial blood pressure; T—time in 6 sec. intervals; Scale at right—mm. Hg.; Male dog 11 kilos; 0.2 per cent acetyl-beta-methyl-choline chloride at positive electrode (45 sq. in.); 10 ma. current.

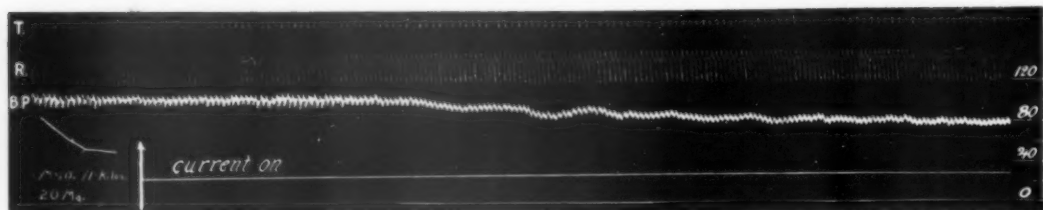


Fig. 4.—B.P.—mean arterial blood pressure; R—respirations; T—time in 6 sec. intervals; Scale at right—mm. Hg.; Male dog 14 kilos; 0.2 per cent acetyl-beta-methyl-choline chloride at positive electrode (45 sq. in.); 20 ma. current.

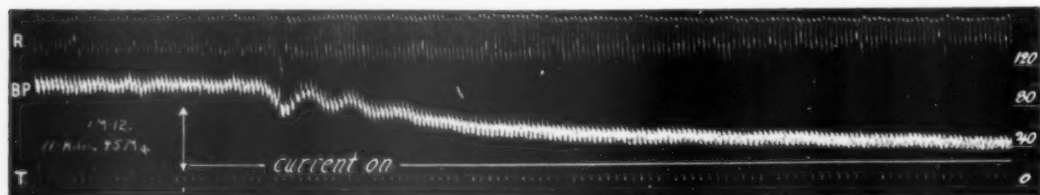


Fig. 5.—B.P.—mean arterial blood pressure; R—respirations; T—time in 6 sec. intervals; Scale at right—mm. Hg.; Male dog 11 kilos; 0.2 per cent acetyl-beta-methyl-choline chloride at positive electrode (45 sq. in.); 45 ma. current.



Fig. 6.—B.P.—mean arterial blood pressure; T—time in 6 sec. intervals; Scale at right—mm. Hg.; Female dog 11 kilos; 0.5 per cent acetyl-beta-methyl-choline chloride at positive electrode (45 sq. in.) 50 ma. current.



Fig. 7.—B.P.—mean arterial blood pressure T—time in 6 sec. intervals; Scale at right—mm. Hg.; Male dog, 16 kilos; 0.2 per cent acetyl-beta-methyl-choline chloride at negative electrode on thigh (45 sq. in.); 45 ma. of current.

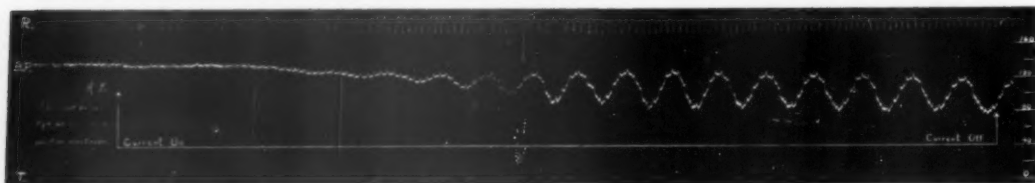


Fig. 8.—B.P.—mean arterial blood pressure; T—time in 6 sec. intervals; Scale at right—mm. Hg.; Male dog, 16 kilos; 0.2 per cent acetyl-beta-methyl-choline chloride at positive electrode with same pad used after negative electrode (45 sq. in.); 45 ma. of current.



Fig. 9.—B.P.—mean arterial blood pressure; T—time in 6 sec. intervals; Scale at right—mm. Hg.; Male dog, 16 kilos; 0.2 per cent acetyl-beta-methyl-choline chloride at positive electrode with freshly soaked pad on thigh (45 sq. in.); 45 ma. of current.

the pad was re-used with the positive pole after a run of 10 minutes with reversed poles serves to show that this drug is not destroyed or completely deposited at the plate electrode, as is the prevailing clinical opinion. However, when a freshly soaked pad is used at the positive pole following these runs, the effects produced are decidedly more pronounced (Figs. 7, 8 and 9). Using varying potentials from 10 to 100 milliamperes, controls run with physiologic salt solution soaked into the pads at both the positive and negative electrodes gave essentially negative tracings.

Discussion and Conclusions

The physiologic effects resulting from the administration of acetyl-beta-methyl-choline chloride by iontophoresis serve to prove that the positively charged part of the molecule is repelled at the positive pole by the galvanic current into the capillaries of the skin, where it most probably is taken up by the blood stream. Our experiments consistently show a lowering of blood pressure and marked salivation as described by investigators using other methods of administration.

The acceleration in heart rate undoubtedly is not parasympathetic stimulation, but may be explained as passive paralleling the lowering of blood pressure.

It has been shown that the degree of concentration of acetyl - beta - methyl - choline chloride in solution, within the limits studied, does not influence the physiologic effects produced. However, the rapidity of action and the duration of effects produced can be fairly well controlled by the amount and duration of current applied.

As yet, no real effort has been put forth to determine what unit amount of acetyl-beta-methyl-choline chloride is actually absorbed by the tissue fluids per milliampere when administered by iontophoresis.

Summary

1. Objective, demonstrable and measurable physiologic effects are obtainable when acetyl - beta - methyl - choline chloride

(Mechoyl) is administered to the intact anesthetized dog by iontophoresis.

2. These effects are produced only by the positive pole of the galvanic current.

3. The rapidity of action and the duration of the effects produced varies directly with the intensity (milliamperage) and the duration of the current.

4. The effects do not depend upon the dilution within a range of 1-200 to 1-8000.

5. The blood pressure reducing action shown by other investigators has been duplicated.

6. The acceleration of cardiac rate duplicates the clinical observations of Weiss and Ellis, but we do not obtain the vagal effect reported in other experimental studies.

6516 Oakland.

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(For discussions of this and the two succeeding articles turn to page 541.)

UNDERWATER THERAPY IN CHRONIC ARTHRITIS *

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Underwater therapy is a conservative, safe procedure based upon the fundamental agencies of physical therapy: heat, exercise, and massage. Its application to the treatment of chronic arthritis aims at the prevention and correction of deformities, restoration and reëducation of the atrophied muscle groups, restoration of joint function and general body tone, and correction of faulty body mechanics. It must be considered as only a part of the general physical therapy program, and as an important adjunct to the proper medical care of the chronic arthritic patient.

Within recent years there has been a vast accumulation of literature on chronic arthritis and especially on the application of physical therapy to this condition. Although there is a marked difference of opinion as to the nature and etiology of the disease, there is agreement as to the value of heat, exercise and massage in the treatment of the deformities associated with the disease. Cecil, Holbrook, Buckley, Irons, Swaim, Sprunt, Coulter, Molander, and many others give heat, exercise, and massage an important place in the treatment of chronic arthritis. Minot, Pemberton and Osgood not only stress the importance of heat, exercise, and massage, but also the favorable influence of these basic principles of physical therapy upon the local and general capillary circulation. Goldthwait, Brown, Swaim, Kuhns and numerous others have emphasized the correction of faulty body mechanics as an important part of treatment.

Therapeutic Exercise

Few of the more recent observers stress the use of muscle training and reëducation in the treatment of the deformities associated with the disease. The concept of therapeutic exercise dates back to 1912, when the late Robert W. Lovette, of Boston, devised a system of exercises based upon a

thorough investigation of muscle function in the various groups. This work has served as a foundation for our present knowledge of the subject. Originally Lovette's work was directed toward the treatment of chronic anterior poliomyelitis, but more recently, Lowman, Coulter, Molander, Kovács, Pemberton, Swaim and others have stressed the importance of muscle training and reëducation in treating the deformities of chronic arthritis.

The mechanics of the production of the deformities of the two diseases is very similar. It is a well known fact that a patient with chronic anterior poliomyelitis performs movement by the use of the strong muscles, permitting the more weakened atrophied muscles to remain idle. The same is true of chronic arthritis. Movements are made with the strong contracted groups, the weaker stretched groups remain idle. Atrophy is progressive and cannot be corrected unless systematic exercise of the affected muscle groups is instituted.

Development of Underwater Therapy

In 1922, Charles W. Lowman, of Los Angeles, using Lovette's work as a basis, conceived the idea of performing these exercises under water and established what he termed "underwater gymnastics." He found this form of exercise to be very effective, and was able to obtain certain physiologic changes and mechanical advantages that could not be obtained out of water. Lowman stressed the importance of the large pool because the range of the application of active exercise was greater than in a small pool operated from the outside. Three years later the Warm Springs Foundation was established, and Le Roy Hubbard and his co-workers gave added impetus to this therapy.

Although underwater therapy has been popularized as a treatment for anterior poliomyelitis, its application to the treatment of chronic arthritis has proved effective. The buoyancy of the water per-

* Read at the Fourteenth Annual Session of the American Congress of Physical Therapy, Kansas City, Missouri, September 11, 1935.

mits a more efficient application of exercise to the weakened atrophied muscles.

The buoyancy of the water is a force acting in opposition to the force of gravity, and is equal to the weight of the water displaced by the immersed body. Therefore, by immersing a chronic arthritic patient in water, one is able to obtain relatively free movement in all planes with a minimum amount of effort by and pain to the patient. This affords the operator a more effective control of the patient, and permits a more efficient application of the exercise program. The buoyancy of the water decreases gravity pull to such an extent that muscle spasm and interarticular tension are greatly lessened, thus increasing the arc of motion without pain to the affected joint while further increasing the effective range of the exercise.

The buoyancy of the water moreover aids the application of exercise in that it permits a more accurate exercise dosage to atrophied, weakened muscles, with a minimum amount of motion in the opposing groups. With these fundamental facts in mind, one can readily see that exercises, otherwise impossible to perform, can be carried out with comparative ease in water. As an example, patients with marked flexion deformities of the knees can walk in water, whereas out of water, each step is a painful, burdensome task. The amount of passive motion is decreased, which further aids the effectiveness of the exercise.

Heat and Massage

By giving therapeutic exercise in water at a temperature of 98 to 99 degrees F., continuous hyperemia is maintained during the actual time of movement. This aids the buoyancy of the water in producing a general relaxation, decreasing muscle spasm, and increasing the arc of motion of an affected joint without pain. The temperature is sufficient to produce a marked peripheral capillary dilatation, which increases the flow of blood and lymph to the parts, stimulates the nutrition of muscle tissue, and promotes the elimination of toxic waste material. This effect is obtained during the time the muscle is working and greatly increases the amount of work the muscle can do without becoming fatigued. In addition a continuous capillary dilatation during the actual time of muscle move-

ment greatly facilitates the breaking down and excretion of organized inflammatory exudates in and around the muscles and joints. This method of applying heat during the time of exercise is obviously superior to that of superficial heating followed by exercise. The hyperemia produced by dry heat is not constant, the part cools as the exercise progresses; there is a consequent capillary contraction, retention of toxic waste material and the exercise dosage is cut down due to fatigue.

The effectiveness of underwater exercise is further enhanced by the use of underwater massage and the stretching of contracted muscles and ligaments. Light stroking is started as soon as the patient obtains a hyperemia. This stroking is confined to the muscle groups above and below the affected joint, and after relaxation is obtained, heavier reverse stroking is started on the contracted groups. Gentle traction is begun next, and is gradually increased to the point of pain. The stretching is done very slowly but firmly, for it has been found that many contractures can be overcome that would otherwise require surgery.

General deep kneading massage is then instituted under water, and the physiologic effect is greatly increased, due to the continuous hyperemia produced by the heat of the water. Following the massage, the exercise program is started and pushed to the point of tolerance, that is, short of pain and fatigue.

General Physiologic Effects

A continuous peripheral capillary dilatation and a generalized interchange of blood from the deeper congested areas to the surface of the body are effected. The pulse and respiratory rates are slightly increased. There is a lowering of the blood pressure, and a rise of temperature of one to two degrees F. These changes persist as long as four hours after treatment. Following the treatment the patient feels relaxed, and there is an immediate desire for sleep.

The relatively free movement without pain and the performance of exercises in water, such as walking, impossible to accomplish out of water, gives the patient a pleasurable sense of activity which can only be appreciated by one who has been confined to the bed or wheel chair. Courage

and confidence are restored. The patient becomes anxious to try new movements and looks forward to his or her pool treatment. An optimistic mental attitude is developed.

Conclusions

1. Underwater therapy, although popularized as a treatment for anterio poliomyelitis, is applicable to chronic arthritis.

2. Therapeutic exercise aided by heat and massage is essential to the correction of the deformities of chronic arthritis.

3. These exercises are best administered by use of the therapeutic pool in water at a temperature of 98 to 99 degrees F.

4. The buoyancy of the water and the constant temperature during the actual time of movement are factors which favorably influence the disease.

a. The affected joints may be moved through a greater arc without pain.

b. The weakened, atrophied muscles are capable of more work without fatigue.

c. A greater and more accurate exercise dosage may be given.

5. Definite beneficial physiologic changes are obtained.

6. These physiologic changes persist some hours after treatment and are obtained without stimulation to the central nervous system.

7. Underwater therapy produces a favorable psychologic effect.

9 Forrest Hills.

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(Discussions on page 541.)

Pacific Physical Therapy Meeting

The Pacific Physical Therapy Association announces the following program for its next meeting to be held September 25, 1935 at the Hollywood Hospital:

Report of the Fourteenth Annual Session of the American Congress of Physical Therapy:

1. Our Relationship to the American Congress

of Physical Therapy. *John Severy Hibben, M.D., President, Congress, Pasadena.*

2. Education and Registration of Technicians. *Wm. W. Worster, M.D., San Gabriel, Calif.*

3. The Instructional Course. *Cora Smith King, M.D., Pasadena.*

4. Radiathermy. *Cleon W. Symonds, M.D., Pasadena.*

5. Fever Therapy. *Fred B. Moor, M.D., Loma Linda, Calif.*

THE TREATMENT OF ARTHRITIS WITH MASSIVE DOSES OF VITAMIN D*

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There are numerous references in the literature to the treatment of arthritis with cod liver oil and more recently with preparations of known vitamin D potency. Most of these, however, are either reports of a few cases or offer general suggestions. To our knowledge, no extensive study has been made on a large series of cases and none on the use of vitamin D in the massive doses employed in this study.

This is purely a progress report and, therefore, necessarily lacking in certain details. We present it in order that others may investigate the treatment, since it is only by extensive application that the value of any new form of therapy may be determined.

Our experience with the treatment of arthritis by concentrated vitamin D dates from July, 1933, when by chance there were included two cases of arthritis in a group of subjects under observation for hay fever, as described in other publications.^{(1), (2), (3)} One of these was a man aged 46, who seven months before had suffered a severe maxillary sinus infection followed by polyarthritis of such severity that he was obliged greatly to modify his activities. This condition had not been improved to any great extent by any treatment or by the warm season. The other was a woman aged 47, who had suffered atrophic arthritis affecting the ankles, hands and wrists for 15 years. No other form of treatment had given her any lasting relief.

After three weeks of treatment with 200,000 U. S. P. units daily of concentrated vitamin D the patient remarked that for the first time in 7 years she had been able to

remove a ring from her finger. A little later she called attention to the fact that her shoes were too loose around her ankles. It very soon became apparent that she was experiencing marked clinical improvement. This prompted inquiry in the case of the male patient, and it was found that during the month of observation all symptoms of arthritis had disappeared. He continued treatment for nine months, since then there has been no recurrence.

The female patient continued to take as high as 1,000,000 units daily at the height of the hay fever season. After September, 1933, she received from 200,000 to 300,000 units daily up to August, 1935, except for certain periods to be noted.

Progressive improvement has been steadily manifested by greater mobility, reduction of deformity, increased muscular strength as measured by the grip dynamometer, as well as by ability to do more work, and, more markedly, by absence of pain.

In November, 1934, medication was discontinued for a period. About the middle of the fifth week, she began to experience considerable pain in both hands and ankles which, within three days' time, become so severe as to limit activity to some extent. With resumption of treatment these symptoms promptly abated within a week. A similar period without treatment began in May, 1935, and extended for six weeks.

There is now no visible deformity of the ankles, usually no pain and no limitation of motion except to a small degree in the right ankle on extension. The hands are still visibly deformed but there has been extensive reduction in all finger joints, there is practically no pain and only small limitation in both flexion and extension of the left wrist. As in most cases of arthritis, there are apparently spontaneous exacerbations in her

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* The expenses of this investigation were defrayed in part by grants from Mead Johnson & Company and from the Wisconsin Alumni Research Foundation.

clinical condition of sufficient severity to constitute a reminder that the condition is not cured, but these are not prolonged.

The general state of health is greatly improved and even after two years of treatment there is still some measurable evidence of further improvement in the clinical condition. Therefore, it cannot be said that this case is cured inasmuch as improvement is still going on and exacerbations occur whenever treatment is discontinued for several weeks. Whatever constitutes the underlying factor in this case, it has not yet been corrected but is merely held under control. It is possible that when a certain point is reached treatment may be discontinued permanently. The fact that this has been done in some relatively severe cases, six in number, without any recurrence of symptoms of arthritis in 18 months, suggests the possibility that in time this case also may experience a complete cure.

Vitamin D in Arthritis

The favorable experience gained in the two cases prompted us to give the treatment on a larger scale, mainly in the Arthritis Clinic in the Research and Educational Hospital. Besides the clinic cases, which number 67, there are 40 cases under treatment in the private practices of members of the faculty. A series of 22 cases is under observation at the Central Free Dispensary of Rush Medical College and Presbyterian Hospital, and more than 150 other individual cases are under observation throughout the country. Although neither of the two latter groups is included in this report, it may be mentioned that, statistically, the results compare favorably with the series reported in this paper. Table 1 shows the distribution of cases by types and the results of treatment up to the present time. Eventually all subjects in the last column of the table will be distributed between the two preceding columns as continued observation makes possible an evaluation of the results.

We fully appreciate the difficulties in evaluating any treatment of arthritis. We also recognize that we have not utilized all of the criteria that may assist in evaluating clinical results. However, as a progress report, we believe our results merit consid-

TABLE 1. — *Distribution of Cases by Types and Results of Treatment*

	Total Subjects	Clinical Improvement	None	Results Still Uncertain
Atrophic —				
Infectious .....10		5	4	1
Rheumatoid ..24		20	2	2
Hypertrophic —				
Degenerative 14		9	2	3
Menopausal .. 4		1	1	2
Mixed* 3		2	1	0
Miscellaneous				
(G. O.) 5		1	3	1
Arthralgias 7		6	0	1
	67	44	13	10

* One case, infectious and gonorrheal; two cases, menopausal and rheumatoid.

eration as a contribution to the knowledge of this very perplexing problem.

The signs of improvement noted have appeared after periods varying from one week to six months. Neither the severity nor duration of the clinical condition nor the type of condition enable one to predict what may be expected in any given case. In some cases the first sign of improvement was lessened pain, in others improvement in mobility, in still others reduction of edema. In nearly all cases showing any benefit there was general improvement in the nutritive condition, and less evidence of vasomotor instability. As a later result, most cases showed greater muscular strength, less tendency to fatigue, and improved gastrointestinal function.

An exact statistical analysis of the data obtained would not be justified in view of the small numbers of each type and of the variation in the total period of treatment, but the results indicate, however, that this is an efficient form of treatment. Whether it can ever be classed as a cure can be determined only after much more extensive clinical trial and intensive study of factors which may modify or condition the results. From an investigator's point of view, it offers a further valuable method of studying the fundamental nature of arthritis.

Toxicity Due to Concentrated Vitamin D

There is still a question in the minds of most physicians about the possibility of permanent injury resulting from the continued and prolonged administration of large doses of vitamin D. A detailed discussion of this problem was published early in 1934,⁴⁰ since which time additional evidence supports

the statement then made, that concentrated vitamin D is no more hazardous than many preparations used daily by physicians. To be sure, there are precautions to be observed, but the early symptoms are easily recognized even by the patients themselves, and when they appear the administration of the vitamin should be discontinued at once. Usually one or two weeks is sufficient time to allow before resumption of treatment. Of course, if the treatment is continued after toxicity is evident, it is conceivable that permanent injury or even death might occur. This is also true of many other therapeutic preparations which any physician is considered competent to administer.

The most common early symptom of overdosage is persistent nausea; the next most common is increased frequency of urination without necessarily being a polyuria. Other early symptoms are lassitude, anorexia, polydipsia, and, if the treatment is continued, diarrhea, griping pain in the gastrointestinal tract, and vomiting.

In general, arthritic patients will not tolerate vitamin D as well as those suffering from tetany, hay fever and asthma. The reason for this is not known at present.

The only successful means of combating toxicity from overdosage of vitamin D in our experience is the simultaneous administration of a good grade of brewer's yeast. This is not successful in every case nor in excessively large doses. But the following account will illustrate the value of this procedure. A woman, aged 40, on three successive occasions, with intervals of 2 to 3 weeks between, took 300,000 units daily for 10 days, but became nauseated on the 11th day. With the simultaneous administration of 6 grams of yeast three times daily, she now received 200,000 units of vitamin D daily for 3 weeks, 500,000 units daily for 5 weeks, and 600,000 units for 3 weeks, at which time she became slightly nauseated. This case is a fair example of the efficacy of this protective measure.

The total number of human subjects to whom large doses of viosterol have been administered for all conditions now numbers approximately 700. Of these, 63 have, at some time, manifested evidence of toxicity. The actual size of the dose producing toxicity varies in different individuals.

Human subjects have received as high as 3,000,000 units daily for five days. Single larger doses have been given by others.⁽⁵⁾ It is apparent, however, that toxicity is more likely to occur after prolonged administration of moderate amounts than as a result of brief administration of larger amounts.

While statements appear in the literature rather frequently which imply that hypercalcemia is the cause of toxicity, our experience does not support this conception. In both human subjects and experimental animals we have found that severe toxicity, and even death of animals, frequently occurs without hypercalcemia. On the other hand, we have observed the calcium in the blood to be 25 to 30 mgm. per 100 cc. for several days or even weeks without any symptoms of toxicity.

We have now a considerable number of postmortem tissue analyses of dogs which will be reported in detail in another paper, which show that if such animals die or are killed when toxic symptoms are pronounced, excess calcium deposits are present in most of the tissues. But if the administration of vitamin D is discontinued after toxic symptoms become manifest and the animals are allowed to recover, analyses of tissue show the calcium content to be well within the normal range. Microscopic examination of these tissues does not show any evidence of cellular injury. From these observations it would appear that whatever may be the nature of the changes producing symptoms of toxicity, the process is reversible. They also suggest that the toxic effects are primarily dependent upon cellular injury, since microscopic examination shows that calcium deposition occurs only after cells have been injured. It may be deduced further that such injury is repairable in its earlier stages.

The recently reported work of Shelling and Jackson⁽⁶⁾ is confirmed by our observations. These investigators found no excessive calcium deposits in the tissues of human patients brought to autopsy after relatively long periods of treatment with viosterol, although the amounts administered were very much less than in our subjects. We have had no subjects brought to autopsy, hence no analyses of human tissues have been made.

Considerable concern has been manifested about the possibility of the development of hypertension as a result of the administration of viosterol. Records of blood pressure determinations in human subjects ranging from 60 to 75 years of age, who were under this treatment for other causes for two to five years, do not support this view.

Chemical and Metabolic Studies

Extensive chemical and metabolic studies have been made on the various groups of patients we have had under observation. These will be reported in detail at a later date, but at present it may be said that this work has not given us any logical explanation of the mechanism by which this treatment produces the beneficial results actually observed. Many theories may be suggested, but at the present stage of the investigation it would be of little profit to confuse the issue by any discussion of this point. It is doubtful if there is any justification for assuming that arthritis in any form is a vitamin D deficiency disease. The potency of the preparation is such that it may justifiably be considered, from a physiological point of view, as a substance entirely different from the dilute material used in the treatment of rachitic conditions. It is still an unsettled question whether we have been working in a physiologic range of administration of vitamin D. There is evidence both for and against this conception.

We have used in most of this work viosterol from one source.* We have also used calciferol from this same source. In addition, we have used both calciferol** and viosterol*** from two other sources. On the basis of unit dosage we have been unable to discover any difference in the efficacy of the preparations from different sources.

For the information of those who may be interested in the range of dosage, all cases reported in this paper received an initial daily dose of 200,000 U. S. P. or international units. Except in very severe cases, this dose was not increased under any circumstances for a month. So long as there was clinical improvement the dose was never increased. If there was no improvement

and no evidence of sensitivity, the daily dose was increased by 50,000 to 60,000 units each week until there was some improvement or evidence of overdosage. In some stubborn cases it was found necessary to increase to 600,000 or even 1,000,000 for a few days and then reduce again to 200,000 to 500,000 units. Most of our results have been obtained with daily doses of 300,000 to 500,000 units.

The weight of the subjects in a very general way seems to be of some importance, so that it is probable that we will eventually be able to establish a range of dosage per unit of body weight.

So far as we are able to judge at present, there are no contraindications to the use of this preparation in combination with any other known method of treatment of arthritis. In fact, it seems probable that this should be employed in many cases since the vitamin treatment is quite clearly not a complete protective or curative procedure.

Summary

We have presented briefly the general results of two years' experience in the treatment of a small group of unselected cases, including all types of chronic nonspecific arthritis, with massive doses of vitamin D in various forms. In general the results suggest that this material may prove an efficient form of therapy as well as a valuable aid in the study of the fundamental nature of arthritis.

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** Glaxo Laboratories, and Winthrop Chemical Company.

*** Abbott Laboratories, and Parke, Davis & Company.

Discussions

Papers by Drs. Kotkis, et al., Smith, Dreyer and Reed.

Dr. Earl D. McBride (Oklahoma City, Okla.): I am particularly interested in orthopedic surgery, but find it absolutely impossible to treat arthritis of any of the types without physical agents. I think it is very essential, first of all, to recognize a definite classification when we speak of arthritis. Not in a spirit of criticism, but as an observation, all the essayists have mentioned arthritis, without especially limiting their remarks to any particular type of arthritis. We must conclude, then, that their therapeutic measures are applied to any of these types. I believe it makes quite a difference.

The American Committee for the Control of Arthritis divides the disease into two great classes, the atrophic type, and the hypertrophic type. In the average orthopedic clinic we are confronted with two general types of arthritis, the trophic type, which has the changes in the extremities with the crippling deformities, and that which has more of a fibrositis type of general systemic toxemia or infection. They are both very troublesome, but it seems to me we must differentiate in our treatment these respective groups of cases.

It has been my observation that the cases we see, particularly in industrial work, the backaches, the traumatic arthritis and general fibrositis are entirely different in their nature from the so-called rheumatoid type that develops crippling conditions in the extremities. It is a fact that generalized fibrositis never develops the rheumatoid type of arthritis. We do see patients with the rheumatoid type who have a generalized fibrositis, but we do not see, as a rule, the person who has a generalized fibrositis, the type of person that complains of his back, weakness of his legs, fatigue, painful arches, and so on, develop the rheumatoid type. With this in mind it seems to me we can begin to apply these three recommendations that we have heard.

The first essayist, stressed more or less a local treatment, which I think would be particularly successful—mecholy. We have found it successful in a few cases we observed in our clinic. I think it has great potentialities, and I heartily endorse the experimental work because I, for one, am completely blind to the real action that is taking place when treatment is being given. I have to trust the technician to carry out the steps. I don't know how to direct him, and I doubt very much whether he knows much about what he is really doing physiologically. So the work that is being carried out by Dr. Kotkis is very valuable. Perhaps that may apply also to the rheumatoid type, but I believe at the present time it is more competent in the generalized fibrositis type.

The rheumatoid type is managed with the underwater treatment very successfully. I think it is one of the most satisfactory ways of treating these patients who have their legs and knees drawn up, and their arms and elbows stiff and

sore and swollen and red, so that you can hardly touch them. When you get them into this tank you can do almost anything with them while they are suspended in the warm water. The effect is very pleasing and very valuable, and I think we should attempt to establish that treatment in practically all clinics.

One of the first things we learned during the war, when we began to treat stiffened joints, was not to hurt that joint, and we know it is difficult to manipulate any inflamed joint, whether inflamed chronically or acutely, without doing some damage to the ligamentous and the fibrous tissue. Accordingly suspension in water is a very valuable method.

As regards vitamin D, I am totally unqualified to make any remarks. But it goes without saying that we must use some agent of this type to supply what we lack in our natural foods in civilized life. I often wonder why we in the cities are not affected more by arthritis, when our youngsters consume the very foods which tend to produce it. It is really surprising to me that the disease is not more prevalent.

Dr. David H. Kling (Los Angeles): The excellent work by Dr. Kotkis has supported the conclusion which I reached purely by clinical observation, namely, that mecholy iontophoresis is an inferior substitute to histamine iontophoresis for the treatment of arthritis.

The principle of applying peripheral vasodilatation to the affected joint was originated by Dr. Deutsch, who introduced histamine iontophoresis in 1931. I think we all owe him a debt of gratitude for a very simple and efficient measure. The principle of this treatment with any local vasodilator consists of the direct dilatation of capillaries and the arterioles in the skin.

We cannot all do or participate in this type of investigation, yet all one has to do is to apply one drop of mecholy to the skin and prick that with a needle to observe the reaction. You will see a red spot, then a little urticarial wheal, which means an increase in capillary permeability in a flare surrounding it. The flare means a dilatation of the arterioles. If you apply histamine to your hand from the positive pole you will see, with a very low intensity of current, a big patch of urticaria, a big wheal, and you will see that the temperature under the joint is increased. The beauty of it is that you apply histamine for a very short time in order to get the full effect, with a very low intensity of current, and thereby avoid general reactions. This work stood up under a five-year test. All investigators in Europe, with a very few exceptions (I know of only two), have supported Deutsch, namely, that this is an efficient treatment, especially for the soft tissue changes in arthritis, for myositis and tendovaginitis in rheumatoid arthritis.

We could have introduced mecholy. I want to say that the principle is the same. You only substitute mecholy for histamine. Apply one drop of histamine of 1-1000 solution, and then one drop of mecholy of 1-100 solution, prick the skin under the drop with a needle, and you

will see that the wheal and the flare are much smaller with mecholyl than with histamine. When I applied mecholyl to my own arm, using the same method, the same size of electrode, the action was much weaker than with histamine. You have to use three times as much current and apply three times as much mecholyl as with histamine.

Then come the general reactions. When applied to the patient, you will see less immediate local increase in pain from mecholyl than from histamine, but you will see the general effect so beautifully brought out by Dr. Kotkis. You will see the patient getting dizzy, some fainting, and some having a perceptible loss in blood pressure. All these general reactions we found in our clinical experience, and that is the reason that in the August number of the ARCHIVES OF PHYSICAL THERAPY we stated that histamine is still the best for local applications. If I want general application, I will neither use mecholyl nor histamine by iontophoresis. I will use the syringe. Then I know how much to give the patient. I try to avoid the general reactions.

I would like to ask Dr. Reed two questions. Is there any sign in one of these arthritic patients who has no rickets to give us a clue that there is a vitamin deficiency? If you give a high dosage of vitamin, what happens? How does it get eliminated and how rapidly does it get eliminated?

To Dr. Smith, I wish to express my appreciation for his informative paper. Those of us in Los Angeles who have seen the work of Lowman on underwater treatment in poliomyelitis in the Children's Hospital, have tried to obtain like treatment for arthritics. But try and get it! There is no money and no provision. The arthritic patient is the most neglected. We have three million of them. We have 500,000 tuberculous patients. We have 120,000 beds for them, but we have no beds for the arthritics. It is a task to put one of these individuals in an institution. We should concentrate our efforts to obtain for these arthritic patients a square deal.

Dr. Franz Nagelschmidt (London, England): The question of arthritis has been discussed in different ways, and I don't want to enter into the details of classification.

Many roads lead to Rome. It is quite natural that a new treatment, like histamine and mecholyl, arouses a great interest and becomes fashionable. I have applied it in the London Hospital to a great extent, and I must agree with Dr. Kling that histamine is the more effective. There is not only the production of a more distinct wheal, but of an effect of longer duration than any one of its derivatives.

The question whether or not to produce general reaction is of secondary interest, because local results can be obtained by the local reaction alone. I think the effect of histamine producing local hyperemia is the chief mechanism by which it reacts on the joint. This effect can be produced just as well, for instance, by an intense ultraviolet radiation. Here we observe that

such an erythema reacts much longer and remains for days sometimes. Besides, we avoid general reactions, sweating, urination, defecation, and all these troubles which are connected with histamine.

I don't see the difficulty in dosage to which Dr. Kling referred. I think the dosage is dependent on the reaction which we see. If we have a considerable general reaction, then we simply have to stop, and I think we can do that just as well as by injection. What we have injected is in and we can't remove it.

The underwater therapy is a very valuable application which we should not miss in any hospital. But underwater treatment means just momentary relief to the patient in so far as we can avoid contractures, shortening of the ligaments, and so on. It is very valuable and of longer duration. As local treatment of the joint itself, I think it is of importance to give comfort to the patient and enable other mechanical applications to be applied.

Concerning the vitamin application, I am sorry I have had no personal experience, but I think in selected cases it might be of very great value. We know the great inter-relation of vitamins, hormones, the vegetative nervous system on one side, and metabolism on the other side. It is quite clear that in selected cases we might have very good results by changing the local metabolism with general medication. But the danger of applying general medication and leaving it to the joint to pick out just what it needs and submitting the whole body to the effect of increased vitamin medication, which is perhaps not useful, means something requiring careful consideration. I think the local circulation and metabolism of the joint, can be just as well influenced by our different physical methods. For instance, a very valuable method is deep x-ray, x-ray or radium local irradiation of the skin. Ionization with salicylic ions has also proven very useful.

Accordingly we have many methods, and I think the art of the physical therapist consists not only in selecting the special cases indicated, but to combine different treatments, such as underwater to avoid secondary effects of joint diseases combined with some local treatment in the joint itself.

Dr. Bernard Fantus (Chicago): I would like to emphasize the words Dr. Nagelschmidt uttered in differentiating between the medicinal and the physical modalities. It is unfortunate that a separation of such degree is made between medicinal and non-medicinal or physical therapy, because we need both of them. I believe the remark he made is correct, that by means of medicinal therapy it is possible for us to influence the body at large, and that, in a general way, to which no doubt there are exceptions, we are particularly in need of when we combat systemic conditions.

On the other hand, the moment a condition or disease is distinctly localized, grossly localized, we need localizable treatment, and that is

where physical therapy is the therapy par excellence.

Dr. A. J. Kotkis (closing): I don't want to become involved in any arguments as to what iontophoresis is good for. My efforts are concerned principally with the physiologic effects produced. I want to find out in the animal what it does, so we can apply it more intelligently to the human.

I have associated with me, Mr. Albert Kuntz, who is the author of an outstanding work on the autonomic nervous system, and he is becoming tremendously interested in the possibility of iontophoresis. I don't want to say which is the best, mecholyl or histamine. I haven't had enough experience with histamine. In my efforts here I am trying to show you objective, demonstrable, measurable evidence of what is going on.

As to a local or general reaction, if arthritis is a local condition maybe the local effects may be the best. If it is considered a general condition, maybe general effects will be the best. I am not going to become embroiled in that argument. I want to study what is going on, and if I succeed in doing that I will be rendering service. If I don't, I will be disappointed.

We feel that the pharmacology has neglected the incorporation of iontophoresis in the study of certain drugs and its effect on animals. We think it holds a great future. How do we know that the structural chemist will not come to our rescue and put new radicals into compounds, the structural forms of which I have shown you, and be able to drive it in better and control the action as long as we want or cut it short? I hope in the next eight months to have more evidence of what is going on, carrying the work a little further than other investigators, by hypodermic or by oral administration. I am particularly interested at this time in iontophoresis. I am not saying it offers a better approach than the mouth or the subcutaneous tissue. If we know the effects of mecholyl iontophoresis, and want a generalized dilatation, we may choose the method most suitable. The only caution I would urge is not to use mecholyl on asthmatics. If you get too terrific an effect, give atropin immediately, and you will lessen its intensity.

Dr. Euclid M. Smith (closing): I wish to re-emphasize that underwater therapy is only part of the important physiotherapy program of the general care of the chronic arthritic patient. We don't offer this as a new method of treatment, or as a method to cure arthritis, except that we

do feel it is an efficient way to apply heat, exercise and massage.

I am glad that Dr. McBride brought up the question of the classification of arthritis and mentioned generalized fibrositis. This type of case, in which the deformity is out of all proportion to the pathology, responds very nicely to this form of therapy. In a general way I will say that with this type of treatment we obtained better results in the atrophic types of arthritis, which is generally true of other forms of therapy.

Dr. C. I. Reed (closing): Referring to Dr. McBride's comments, we haven't disregarded the accepted classification of arthritis. We have accepted the cases as they have come to us, and then classified them afterward. I have a table of the distribution of cases into the various classes, but I don't think it would have any significance to attempt to analyze statistically those cases because we have only a few of some types. When we get a larger number of cases of each type perhaps we can make comparisons and draw some conclusions as to the applicability of this particular procedure in some one type.

In answer to Dr. Kling's question, I mentioned in the paper that it is very doubtful if we can consider arthritis a vitamin D deficiency disease in any part of its picture. That may or may not be true. We can't settle the question. I don't think it is. I think we are working with a purely pharmacologic agent, in the same sense that any other botanical drug is classified.

As to what becomes of vitamin D, we have done many experiments. Some of it is eliminated in the feces, variable amounts depending on the type of diet. Amounts ranging all the way from twenty to forty per cent are lost in that way. Part of it is inactivated, and part of it is lost in the active form. We have some evidence of elimination by way of the kidneys, but that evidence is not complete and I don't think we can say anything very conclusive about it at present.

Both Dr. Nagelschmidt and Dr. Fantus have mentioned the matter of general as compared to local treatments. We have suggested this only as a general measure. It is obvious that there must be some systemic condition that makes a person susceptible to arthritis, as compared to another individual who doesn't acquire the condition although he may be subject to the same sort of attack. So there must be some underlying constitutional condition, and if this is to have any importance in the general treatment of arthritis, it will be for that purpose, so far as present evidence goes.

SOME EFFECTS OF ELECTRIC CURRENTS ON HUMAN RESPIRATORY MOVEMENTS *

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In February, 1934, we⁽¹⁾ presented the first experiments on the effects of therapeutic electric currents on the rate and amplitude of normal human respiratory movements.

We employed a technic for the galvanic and the interrupted galvanic currents of placing a 3x5 pad electrode (moistened with 2 per cent saline solution and connected with the positive pole) over the lower dorsal vertebrae (splanchnic nerves) posteriorly and a 4x6 inches wet electrode of like construction, connected with the negative pole, on the abdomen just below the costal margins anteriorly. Moistened electrodes of similar composition and position were employed also for sinusoidal and faradic treatments.

In the study of diathermy, a 3x5 twenty gauge metal foil electrode was placed posteriorly over the dorsal vertebrae with a 5x5 electrode of the same material on the abdomen just below the costal margins anteriorly; for autocondensation the subject was seated on a deKraft chair grasping the metal knob on each arm of the chair in the right and left hand respectively; and, for the application of the Oudin current, a 5x5 twenty gauge metal foil electrode, attached to the appropriate outlet of the apparatus, was placed over the lower dorsal vertebrae posteriorly.

While, on the one hand, for the static wave treatments, a 5x5 metal electrode of twenty gauge foil, connected to the positive terminal, was set over the splanchnic nerve root area posteriorly, on the other, for the static induced current, a 3x5 twenty gauge metal foil electrode was placed posteriorly over the same area with a 5x5 similar electrode over the abdomen just below the costal margins anteriorly. Each of these latter electrodes was connected to a Leyden jar, attached to one of the terminals of the static machine.

All treatments were given for fifteen minute periods. Dosage with the galvanic current

was 20 ma., with the interrupted galvanic and the sinusoidal currents 15 ma., while the faradic current was adjusted to produce visible contractions of muscle. The dose of diathermy was 1000 ma., for auto-condensation 700 ma., while with the Oudin current a $\frac{1}{8}$ inch spark was drawn from the subject. In treatments with the static wave a two inch spark (12 plate machine) with a discharge of about 80-100 sparks per minute, and with the static induced current a one-half inch spark (12 plate machine) were administered.

Respiratory Movement

The muscular movements of respiration have been studied⁽²⁾ by recording the movements of a selected area on the surface of the chest, and the respiratory air movements by recording intra-pulmonic, intra-thoracic and intra-abdominal pressures prior to and immediately following treatments with the galvanic and the interrupted galvanic, the faradic and the sinusoidal, the high frequency (diathermy, auto-condensation, Oudin) and the static wave and static induced currents.

The inspiratory enlargement in its transverse diameters of the thoracic cavity by the raising of the ribs⁽³⁾, chiefly effected through the external intercostal muscles⁽⁴⁾, may be recorded by means of a rubber bag⁽⁵⁾ (like that of a sphymomanometer firmly fixed in position over the anterior surface of the right side of the chest. This rubber bag was inflated to the required degree through a by-pass in the tube connected with a water manometer, and records of quiet respiration with each modality were obtained.

The intra-pulmonic pressure⁽⁶⁾, that is the pressure in the interior of the lungs and in the air passages, was considered. As this air is in free communication with the atmospheric air, its pressure⁽⁷⁾ is equal in every position of respiratory rest to that of the atmosphere. The free end of a wide-bore glass tube⁽⁸⁾, connected by a rubber hose to a water manometer, was inserted into one nostril; and, with the lips closed, records of the flow

* Read at the Thirteenth Annual Session of the American Congress of Physical Therapy, Philadelphia, September 12, 1934.

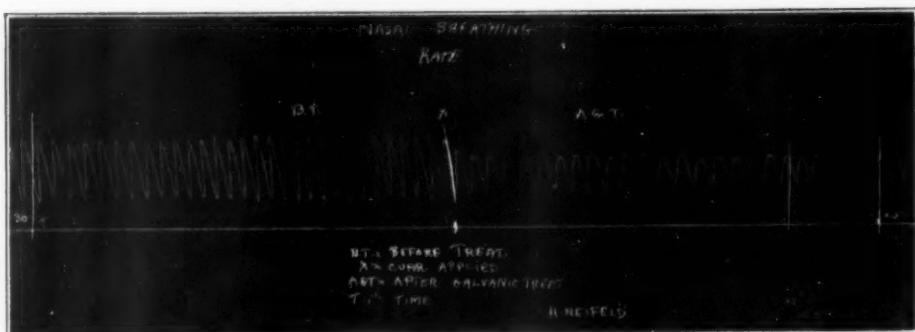


Fig. 1. — Tracing showing galvanic treatment; B. T. — before treatment; X. — Current applied; A. G. T. — after galvanic treatment; T. T' — time.

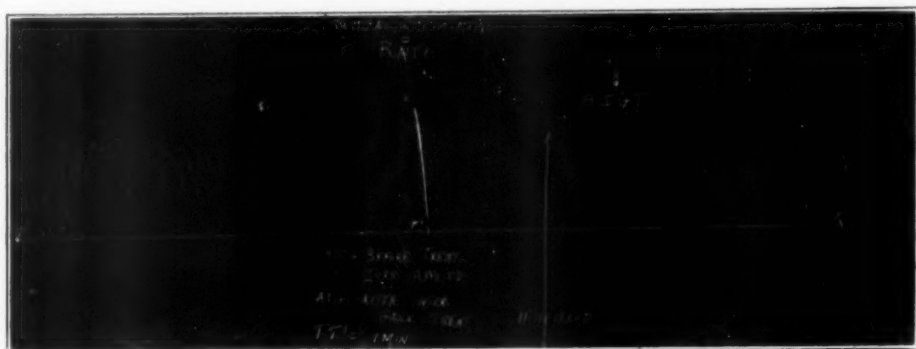


Fig. 2. — Tracing representing interrupted galvanic treatment; B. T. — before treatment; Current applied. A. I. G. T. — after interrupted galvanic treatment; T. T' — time.



Fig. 3. — Tracing representing faradic treatment; B. T. — before treatment; X. — Current applied; A. F. T. — after faradic treatment; T. T' — time.

of air, before and after treatments with the currents were obtained.

Intra-thoracic pressure, that is pressure in the thorax outside of the interior of the lungs and the air passages⁽⁹⁾, under normal conditions, is always negative — that is, atmospheric (intra-pulmonic) pressure minus the elastic force of the distended lungs. The changes in intra-thoracic pressure in ani-

mals⁽¹⁰⁾ may be obtained by passing a sound connected at one end with a tambour, down the esophagus till its free end lies in the intra-thoracic area. In the cases studied here, a duodenal tube attached to a water manometer and with a balloon over its metal tip was passed down to its position in the esophagus (i.e., one-half the distance to the first mark on the tube). After inflating the balloon to

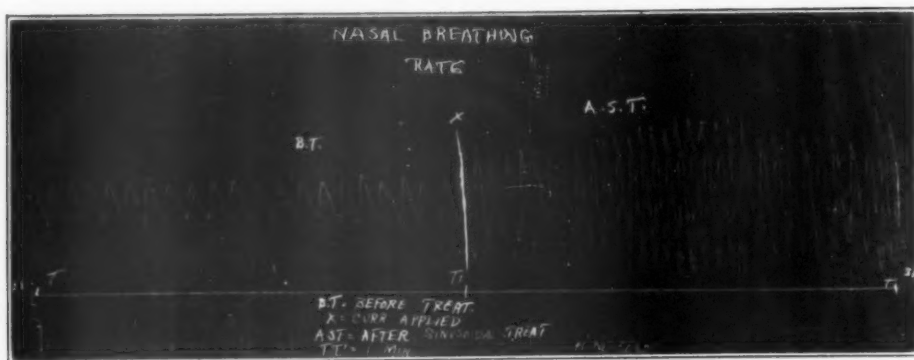


Fig. 4. — Tracing representing sinusoidal treatment; B. T. — before treatment; X. — Current applied; A. S. T. — after sinusoidal treatment; T. T' — time.

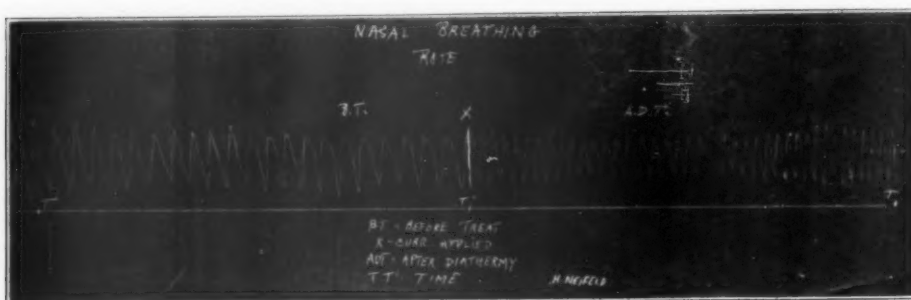


Fig. 5. — Tracing representing diathermy treatment; B. T. — before treatment; X. — Current applied; A. D. T. — after diathermy treatment; T. T' — time.

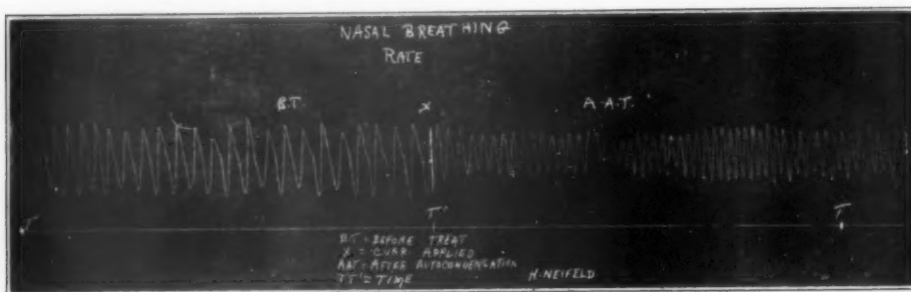


Fig. 6. — Tracing representing autocondensation treatment; B. T. — before treatment; X. — Current applied; A. A. T. — after autocondensation treatment; T. T' — time.

the proper degree, records were obtained before and after the usual 15 minute treatment.

During inspiration, the diaphragm presses on the contents of the abdomen⁽¹¹⁾, thereby producing an increase of intra-abdominal pressure⁽¹²⁾. This pressure or the movements of the diaphragm⁽¹³⁾, in animals is recorded by either thrusting a tambour between the diaphragm and liver, or by hooks attached to muscular slips of the diaphragm itself. After passing a duodenal tube with a balloon over its fenestrated tip into the stomach and distending it to the required degree, records of

the intra-abdominal pressure in the subjects under examination were secured, before and after treatment with each type of current.

Respiratory Tracings

In the tracings obtained following treatment with the galvanic current the amplitude and rate of respiration were decreased, in these after the interrupted galvanic, the amplitude was increased, and the rate decreased, in the graphs of the post-sinusoidal, faradic, static induced and static wave treatments, the amplitude and rate were increased, while the

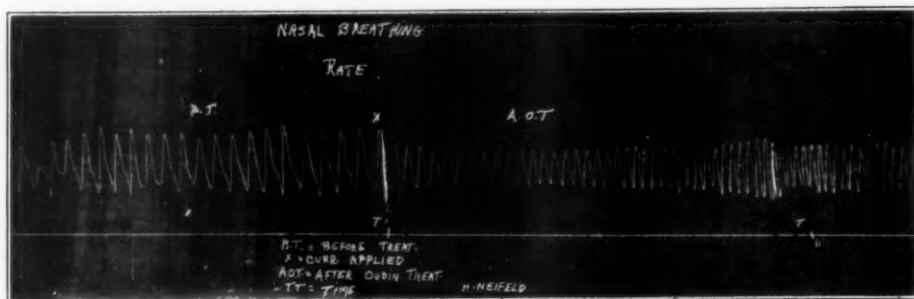


Fig. 7. — Tracing representing ouden treatment; B. T. — before treatment; X. — Current applied; A. D. T. — after ouden treatment; T, T' — time.

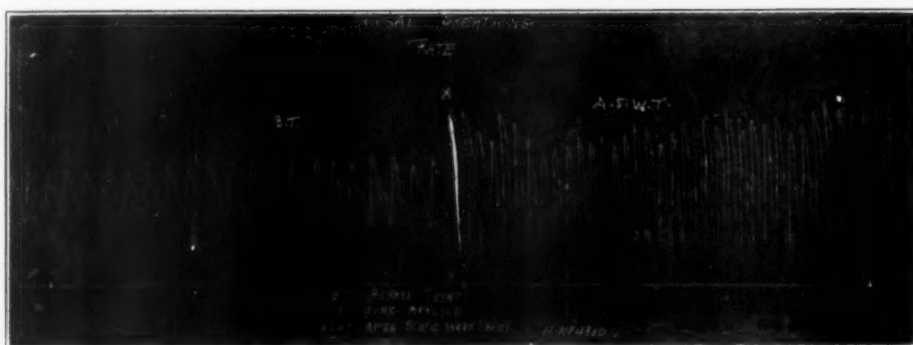


Fig. 8. — Tracing representing static wave treatment; B. T. — before treatment; X. — Current applied; A. S. W. T. — after static wave treatment; T, T' — time.



Fig. 9. — Tracing representing static treatment; B. T. — before treatment; X. — Current applied; A. I. S. I. — after interrupted static treatment; T, T' — time.

decrease in amplitude following treatment with the high frequency currents was accompanied by an increase in the rate of the respiratory movements.

Despite the lack of direct evidence enough indirect data are found in the literature to support these results. Remak⁽¹⁴⁾ stated that one of the effects of the galvanic current is the increased power of inhibition of the tissues, and d'Arsonval⁽¹⁵⁾ showed that though the constant current did not effect the respira-

tory exchanges, the faradic⁽¹⁶⁾ augmented them. Moreover, the respiratory gaseous exchanges following treatment with the sinusoidal current⁽¹⁷⁾ are increased more than 25 per cent. While Rechow⁽¹⁸⁾ after 30 minutes of diathermy observed that the subject consumed less oxygen and gave off less CO₂ than before, it is common knowledge⁽¹⁹⁾ that there is an increase of 5 to 6 respirations per minute per 1 degree rise in rectal temperature. Then, too, the static wave⁽²⁰⁾, though it pro-

duces results somewhat similar to the sinusoidal and the Bristow-faradic, has greater constitutional effects. Finally, since the amount of air⁽²¹⁾ that enters the lung is proportionate to the degree of fluctuation in the volume of the pleural cavities and the incident fluctuation in the intra-pleural pressure, it follows that the more vigorous the action of the respiratory muscles, the greater the respiratory or vital capacity.

Although the effects of these electric currents in therapeutic doses on respiration have not been proved to be due to a direct action on the lungs or diaphragm⁽²²⁾, the physiologic data indicate that the effects depend upon the stimulation of the afferent nerve endings of the skin⁽²³⁾ (reflex stimulation)⁽²⁴⁾. Stimulation of any of the sensory nerves of the body (as a dash of cold water on the skin as well as through the optic and acoustic nerves⁽²⁵⁾), may alter the rate or amplitude of the respiratory movements. Interrupted currents⁽²⁶⁾ stimulate the sensory nerve ends of the skin, contractions of voluntary muscles being obtained reflexly.

Summary

These experiments indicate that the above mentioned electric currents can alter the rate and amplitude of respiration in the following manner: 1. The galvanic currents decrease both the rate and amplitude. 2. The interrupted galvanic increases the amplitude and decreases the rate. 3. The high frequency currents decrease the amplitude but increase the rate. 4. The sinusoidal, the faradic and the static wave and induced currents increase both the rate and amplitude of the respiratory movements.

167 Willoughby St.

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Discussion

Dr. Joseph R. Morrow (Ridgewood, N. J.): In the Contagious Hospital of Bergen County, N. J., we find extensive application of physical therapy. I have recently followed some of the work of Dr. Neifeld on the effects of electrotherapeutic currents on human respiratory movements. It opens up possibilities of the application of this procedure in the treatment of tuberculosis. We use physical therapy extensively in non-tuberculous cases, and in tuberculosis, but in pulmonary tuberculosis we may have something that is going to be worth quite a bit.

From the clinical standpoint, the decrease of three or four respirations a minute may be of value. That is not the only effect on the human mechanism, but the resulting complex relation may be far-reaching. We should follow this research and endeavor with diligence to find just

what we can accomplish with it. We can trust that the tissue destruction with the various chemical reactions, some of which are known and others of which are not known, has a tremendous influence on the human mechanism. We should follow this research and trust that the results will be as beneficial as we anticipate.

Dr. Harry Eaton Stewart (New Haven, Conn.): This paper is a very commendable effort to introduce a type of scientific background which our work has so sadly needed. Again and again has the note been stressed that we badly need closer association with the physiologic, and the pathologic laboratory.

As I studied the paper and the results, it seemed to me that the fundamental differences in the therapeutic action of the currents discussed haven't been taken into consideration. The result verified the sedative effect of the high frequency currents. However, I have some doubt

as to the definite effect mentioned by Dr. Morrow. It would be interesting to find out more about that possibility and perhaps Dr. Neifeld might become sufficiently interested to repeat the graphs an hour later and see if there is a slight elastic effect to the treatment. I think that the muscular contraction effect from the interrupted galvanic current is direct on muscle tissue and not reflex. It seems to me that therefore there was in the work so far covered not enough clear-cut and definite results, but it is a start on a pathway that we so badly need.

Dr. Harold Neifeld (closing): The reference I made as to the action of the sinusoidal and the interrupted galvanic was to point out that there was no actual proof of whether the currents acted directly on muscle or skin, but the data indicated that it did act reflexly. I hope others who are interested in electrophysiology will either confirm or disprove any effect presented in my studies.

IONIZATION TREATMENT OF HAY FEVER *

J. R. WALKER, M.D.; B. F. WALKER, M.D., and G. W. WALKER, M.D.

FRESNO, CALIFORNIA

There is much general interest at present on the subject of ionization. Many papers have been published dealing with the method, but its precise action in nasal allergy remains unsolved. McFarlan⁽¹⁾ recently stated in one of his articles that if anyone finds out how it works, "I wish he would tell me." Warwick,⁽²⁾ Stevenson,⁽⁴⁾ Hollender,⁽⁵⁾ Alexander,⁽⁷⁾ and others, have related their experiences, but in spite of this information, there is still much to be learned concerning the action of ionization in hay fever and allied conditions.

In performing zinc ionization a solution of the zinc salt is placed in contact with a body surface, a galvanic current is passed through it, and one of the radicals of the salt is deposited on the tissues. The ions being electrically charged, were formerly

thought to be introduced into the tissues. If so at all, it is likely only superficially, as observation with the spectroscope has failed to find any deposit at an appreciable depth in the tissues. After the treatment the mucous membrane is left with a greyish discoloration all over it, but in a short time after the secretions begin flowing freely the membrane returns to its normal color.

Warwick,⁽²⁾ has devised an apparatus for the use of the direct current in ionization which he thinks excels. We have used the Warwick apparatus and technic. We know of no reasons why this method is superior to others, but having obtained good results with it and we are continuing its use. Warwick⁽³⁾ uses a preparation of 2 per cent solution of the sulphate of zinc, cadmium and tin. Some have used other metallic solutions and are of the opinion that a solution of zinc alone is as good as any combination.

* Read at the Western Sectional Meeting of the American Congress of Physical Therapy and the Pacific Physical Therapy Association, Los Angeles, June 27, 1935.

Clinical Observations

In the San Joaquin Valley, California, hay fever is with us always from early spring until frost. In Coca, Thomen and Walser's work on Asthma and Hay Fever, there is a statement that in some of our pollens in the West we have a seven times more severely irritant allergen than in any pollen east of the Mississippi River. In a very dry atmosphere pollens will blow hundreds of miles. Many people will have hay fever all summer and asthma in the winter. Asthma seems to be less a torment in the dry interior valleys than in damp climates. House dust, feathers, epidermals and food products come in for their share in etiology as well as bacterial allergy. Hollender⁽⁶⁾ and others have reported good results in treatment of other than oculonasal pollenosis by ionization. We appreciate it especially in treating hay fever and closely allied conditions. In these cases the family history usually tells of hay fever, asthma or urticaria on eating certain foods, in the ancestry, or in other lineal or collateral relatives.

Our patients ranged in age from seven to eighty-two. All but one of our patients were treated under local anesthesia. One of these seven year olds recited poetry much of the time while being treated. For one of the children treated a general anesthetic was given.

The octogenarian is a physician who has had some coronary trouble. In his case only one nostril at a time was treated, cocaine and adrenalin being applied sparingly. One patient, aged seven, had mild perennial hay fever and frequently recurring minute corneal ulcers. Ionization was done several months ago, since which time there has been no recurrence of eye and nasal symptoms. Certainly the recurrence of her corneal ulcers depended upon her oculonasal allergy as they recurred along with the nasal exacerbations. Ionization has been used for the perennial type of rhinitis that does not depend on sinus suppuration with almost uniformly good results.

Nasal polyps may be due to sinus suppuration alone or to allergy alone depending upon the nature of the case. In a patient on whom an intranasal antrum operation had previously been done and in succeeding years polyps had been removed from the middle meatus because

of nasal obstruction, desensitization gave disappointing results in relieving hay fever symptoms. Ionization was performed with prompt relief of these symptoms and in addition a thorough shrinkage of the polyps so that they could not be seen on inspection of the nose.

In administering the treatment we have always tried to reach the region of the sphenopalatine ganglion, as the work of Sluder and others has shown intimate relation between it and the enervation of the deeper parts of the respiratory tract.

Effects of Ionization

Warwick believes there is more than local action. Many patients who have been treated by ionization are extremely nervous during the period of reaction after the treatment, entirely out of proportion to the pain of which they complain. We have found that this nervousness is better relieved by barbiturates than by morphine. The morphine seems to relieve the pain best but not the nervousness, a fact we have thought indicates a systemic rather than a local effect.

Within about ten minutes after ionization treatment has been started, the patient will complain of stinging in the nose and headache. These symptoms require for relief a fairly large amount of anodyne. The pruritus and other hay fever symptoms are relieved promptly on treatment. The discomfort lasts from four to six hours. A gelatinous exudate fills the nasal chambers for from two to four days, after which it is blown out. Symptoms of an ordinary acute rhinitis persist for a few days more.

We prefer to treat patients in the season rather than pre-seasonally. In the season the patient is more in the mood to submit to the treatment and better appreciates the cessation of the hay fever symptoms. Many of us who have followed the Warwick method prefer ionization to any other method extant for the affections enumerated above.

Toby of Boston in a recent article on ionization in hay fever, said he thought it a good remedy but desensitization was the treatment of choice. I think that might possibly be true for pollenosis as it exists east of the Mississippi River, but in the semi-arid West where the pollens blow for long distances and the season often lasts

from early spring until frost, we now believe that ionization is decidedly the treatment of choice.

Evaluation of Treatment

It will take some time and experience before we can say we have cured cases of hay fever, but certainly as Hollender⁽⁵⁾ has said, "Ionization is a prolonged palliative." About 25 per cent of the cases return the following season after ionization. Warwick,⁽²⁾ however, reports cases treated as far back as 1927. These have had no recurrence after one treatment, and while some cases of hay fever are relieved spontaneously during one season and fail to return the next season, there is certainly no such proportion in untreated cases that fail to return as there is after intranasal ionization.

One attempting to do this work should be well versed in allergy. A good history should be taken, and as has been pointed out by Lamson,⁽⁷⁾ *et al.* much of the information upon which a diagnosis can be made, can be gotten by it. Of course, skin tests are a big part in the diagnosis. The presence of an increase of the eosinophiles in the nasal secretion is another evidence. One should differentiate between the family strain of allergy, sometimes called atopy, and bacterial allergy.

One using ionization to treat an asthmatic who suffers from the results of an unresolved pneumonia or sinus full of pus, will be doomed to disappointment. Those patients fare much better in the hands of the allergist, and, in the sinus cases with whatever help the rhinologist may give him. To carry out intranasal ionization satisfactorily, requires training in rhinologic diagnosis and treatment. If there is need of a submucous resection of the septum one should not try to do ionization without it. It takes one experienced in ocular examination of nasal structures to be able to succeed in differentiating between subacute and chronic sinus disease and some cases of hay fever.

Some have advised the use of lower amperage in treating children as compared with adults. We have not been able to see any difference in using 10 milliamperes in our seven year old patients than in the adults. We use 10 milliamperes for ten minutes in each nasal passage.

Some people who have hay fever say they

never have a cold, but quite a proportion say that they have hay fever in the summer and colds all winter. Those of the latter class have told us that ionization stopped their hay fever and the frequent colds that they had been having before.

Effect of Ionization on Nasal Mucosa

As to the effect of ionization on the nasal mucous membrane, there is a temporary irritation and a more or less crusty nose or dried secretion over the turbinate, and to a slight extent, on the septum following ionization. This always clears up and leaves a thoroughly normal looking mucous membrane. The speed of its clearing up varies in different cases. One case that we treated last year had a decided need of a middle turbinotomy. On contemplating it this seemed a good case to ionize and later examine the tissues. After a few weeks following treatment the turbinotomy was done and the tissue examined by a pathologist. He stated that the specimen was covered by ciliated epithelium and seemed normal. Warwick⁽³⁾ has so reported earlier.

Certainly macroscopically we can find no trail of damage from ionization a short time after the symptoms of the acute rhinitis subside.

Patterson Building.

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THE USE OF IONTOPHORESIS *

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NEW YORK

The subject of the treatment of arthritis and kindred diseases by physical therapy is exciting great interest, as is evidenced by frequent enthusiastic publications. Properly to evaluate the end results obtained by this method in combination with medicinal agents it is essential to study both the physical modality and the drugs entering into the management of the arthritides.

Of great importance is the galvanic current. It is a constant unidirectional current of relatively low voltage, low amperage, with distinct polarity, a marked chemical action, and a mild thermic effect. The positive pole attracts negative ions and radicals and the negative pole attracts positive ions and radicals. The ions can be introduced only into the most superficial tissues of the body, the maximum migrating amount per unit charge transferred in one milliamperere hour roughly being 1 mg. copper, 2 mg. zinc, and 5 mg. salicylates.

We decided to give iontophoresis a thorough trial to determine whether the reported results could be duplicated or were merely waves of enthusiasm. With this object in view, we studied 90 arthritic patients who were receiving various forms of physical therapy without any appreciable improvement. These patients were selected either from the outpatient department or from the wards of Beth Israel Hospital. The diagnoses were confirmed by x-ray findings, except where the pathological changes were evident. We endeavored to have such foci of infection as carious teeth and infected tonsils removed prior or during the course of treatment.

The physician who has experience in treating ambulatory patients is well aware of the difficulties and disappointments which confront him when he attempts to carry out a routine eradication of possible foci of infection, institute rest and adequate elimination through the intestines, bladder and skin. Most of these patients are willing to report for treatment as often as desired, but their co-operation in other respects is negligible.

* From the Department of Physical Therapy, Beth Israel Hospital, New York.

* Read before the New York Physical Therapy Society, New York, March 6, 1935.

In order to ascertain any difference in the results obtained from different drugs, we divided our patients into the following groups: The first received tap water, the second saline solution, the third 2 per cent sodium salicylate, the fourth 2 per cent lithium citrate, the fifth 2 per cent potassium iodide, and the sixth histamine acid phosphate 1-1000. The strength of the current employed was from 1/10 to 1/4 ma. per square inch of the active electrode. The duration of treatment was 30 minutes. In histamine, the active electrodes were 10 x 10 cm. The strength of the current was 20 ma. for two minutes.

The findings in the several groups were:

1. The medicinal agent employed had no influence whatever on the course, duration and number of treatments necessary, with the exception of histamine.

2. The patient's reaction to ordinary tap water was similar to that of the other solutions employed.

3. All drugs resulted in a superficial hyperemia of the part treated, similar to that which is obtained with any counterirritant.

4. The therapeutic results obtained were due to the selective effects from the positive or negative pole of the galvanic current.

Histamine being a recent addition to the armamentarium of physical therapy its detailed description may not be amiss. It is the most powerful of the ergotamines, causes a dilatation of the capillaries and is used in medicine solely for the purpose of producing gastric secretion in functional tests of the stomach. Dale and Richards showed that histamine is a poison which may cause urticaria. When applied with the positive pole histamine produces wheals immediately under the electrode with a resultant pruritus which lasts for about one-half an hour. The method of application is as follows: Two pieces of white blotting paper, 10 x 10 cm. are saturated with a 1:1000 histamine acid phosphate solution and 1:100 chlorethane. The latter acts as a preservative. These are superimposed with a similar sized piece of block tin, and placed in close proximity to the part treated in the antero-posterior position, and held in place by

a roller bandage. A bifurcated cord is attached to the electrode from the positive pole, the indifferent electrode being placed under any other part of the body. The current is gradually turned on until 20 ma. are reached and maintained for two minutes. The duration of treatment is limited to two minutes and more than one joint may be treated at the same time by increasing 10 ma. for each additional electrode. The patients usually reported a marked improvement in their subjective symptoms after receiving the first treatment. The advantage of histamine treatment is self-evident.

In the treatment of various forms of bursitis, myositis and neuritis excellent results were likewise obtained with histamine. Why such excellent results were obtained is difficult to explain theoretically. Experimentally and empirically we are forced to conclude that when the relief of certain signs and symptoms follows certain therapeutic procedures, that these methods effected the relief.

All who treat arthritic patients have seen spontaneous exacerbations of symptoms, which clearly show the fallacy of accepting immediate therapeutic effects as permanent. We know that structural changes in the joint or joints cannot be entirely eradicated under any form of treatment. If, on the other hand, we obtain good function in a joint in only a few patients, or the amelioration of pain in some, our efforts are amply rewarded.

Case Histories

The following cases illustrate that the therapeutic results were due to the selective effects of the positive or negative pole of the galvanic current and not to the medicinal agent employed. (For the sake of brevity I shall not give complete histories but only the salient points.)

CASE 1. — (Mrs. McG.) *Diagnosis* — Right sacroiliac arthritis.

Treatment. — April 19, 1933 to April 22, 1933. Four treatments consisting of radiant light and heat followed by histamine to the right sacroiliac joint. January 17, 1935, patient states that prior to our treatment she suffered from similar attacks which lasted from four to six weeks, during which time she was confined to bed. The last attack lasted only four days and she has had no recurrence since.

CASE 2. — (H. S.) *Diagnosis* — Arthritis of ankle joints.

Past history. — In Bellevue Hospital from February to May, 1933, for rheumatic fever involving the ankles, knees, hands, elbows and left shoulder. Present history. After his discharge

from the hospital, he felt well and returned to work until July, 1933, when his feet began to ache.

Treatment. — August 24, 1933, to September 26, 1933. Seven treatments with histamine. February 7, 1935. Feels perfectly well since last treatment.

CASE 3. — (Mrs. F. K.) *Diagnosis*. — Arthritis of right shoulder.

Treatment. — December 13, 1932, to May 2, 1933. Twenty-two treatments with tap water. February 21, 1933. Marked improvement; is able to move shoulder in all directions. January 22, 1934. Since cessation of treatments, she only experienced discomfort in the shoulder during rainy weather, but motion is not restricted.

CASE 4. — (Mrs. F. M.) *Diagnosis*. — Subdeltoid bursitis.

Treatment. — August 1 and 2, 1933. Two treatments with histamine to the shoulder. January 23, 1935, feels well after second treatment. No recurrence.

CASE 5. — (Mrs. A. N.) *Diagnosis*. — Myositis of right thigh.

Treatment. — August 15, 1933, to November 28, 1933. Twelve treatments of radiant light and heat followed by histamine to right thigh. January 17, 1935, felt perfectly well for one year. Since then she feels discomfort during changes in weather.

CASE 6. — (R. B.) *Diagnosis*. — Bilateral sacroiliac arthritis. Lumbosacral arthritis.

Past history. — Was treated in the orthopedic department by means of a plaster cast for six weeks, which was followed by a leather jacket in October, 1932, without any relief.

Treatment. — January 24, 1933 to May 2, 1934. Sixteen treatments with lithium citrate, 2 per cent, to lower back. March 23, 1934, patient feels very good. Feels well enough to cease treatment. January 15, 1935. Patient experiences slight pain in lower back which lasts about three minutes, when he attempts to lift heavy weights.

CASE 7. — (Mrs. B. G.) *Diagnosis*. — Subdeltoid bursitis.

Treatment. — August 15-18, 1933. Four treatments of radiant light and heat followed by histamine to the shoulder. February 21, 1935. Feels perfectly well since the last treatment.

CASE 8. — (Z. R.) *Diagnosis*. — Arthritis, right shoulder.

Treatment. — August 11, 1933, to September 13, 1933. Twelve treatments consisting of radiant light and heat, followed by histamine to the right shoulder. February 19, 1935. Complete relief from the treatments. No recurrence.

CASE 9. — (Mr. A. K.) *Diagnosis*. — Traumatic arthritis.

Past history. — Four months ago patient's knee was struck by an icebox door. Two months ago he began to feel pain in the knee especially during change in weather. Inability to walk upstairs or stand for any length of time. Pain became worse.

Treatment. — April 25, 1933. May 9, 1933, two treatments of radiant light and heat followed by histamine to left knee. January 29, 1935. Feels perfectly well since last treatment.

Conclusion

Observations on 90 patients are hardly sufficient to base an opinion on the efficacy of a form of therapy. Nevertheless it is my belief that the galvanic current can be compared favorably (if such comparison is possible) with any other physical agent.

It is my purpose to pursue further studies in the treatment of arthritis and its kindred diseases by combining galvanism with other modalities and to note the results. Theoretically it seems reasonable to expect better results from a combination of diathermy with galvanism. What the results will be I hope to report in a future communication. All I wish to emphasize is the fact that the galvanic current is an important adjuvant, that it is not a specific, and that it is beneficial in selected cases, when properly administered. It is indicated to increase local circulation and nutrition.

24 East 11th Street.

Discussion

Dr. Victor Stoll (New York): Iontophoresis and electrolytic or ionic medication express the same idea of introducing foreign ions into tissues for therapeutic effects. At the March meeting of the New York Physical Therapy Society, Dr. Levant presented a number of arthritic cases. He reported his cases from a clinical standpoint, stating that these cases were treated in groups with the galvanic current and with different solutions: sodium chloride, lithium citrate, sodium salicylate, and histamine. They all respond in the same way, showing improvement. The cases treated with histamine showed more striking results. He concluded that the solutions themselves apparently did not have any special effect, except those in which histamine was used.

If the solutions or the foreign ions introduced by the galvanic current (except histamine solution) into the affected parts did not have any effect and an improvement in the condition was still obtained, what then was the active therapeutic agent in the treatment of these cases? Nothing else but the galvanic current! Galvanism itself is of tremendous therapeutic importance and is usually overlooked. The presentation of the cases by Dr. Levant forcefully brought out the fact that the galvanic current itself deserves our greatest attention as a therapeutic agent.

The medical and surgical application of galvanism is primarily not a drug treatment, although it is possible to introduce active principles of drugs with the galvanic current into a local area. Galvanism itself with its influence on physical, chemical and electrical states of matter in general and on living matter in particular, must be first considered.

How amazing is it to read the records of remarkable clinical results obtained with galvanism in a great variety of diseases by such mas-

ters as Julius Althaus, Erb, and many others, when we consider how little theoretical knowledge about the current was had in those days. Nevertheless their keen observations and precisely recorded clinical experiences stand out indelibly even today, so that there is hardly any necessity for additional clinical proof of the efficacy of galvanism.

What really is needed is the coordination of a great mass of facts lately accumulated by a number of researchers in many fields of medical science and to combine this information from all the different sources into one practical working unit. It means bringing consciousness into our work, that renders the application and methods more understandable and even obvious.

Simple as the outfit and the mechanical application of galvanism appears, its intelligent use in the treatment of many diseases is not elementary, due to the manifold effects produced in the tissues by the passage of the current. These effects can be divided into two groups: (1) The polar effects, which are different and antagonistic, and (2) the interpolar effects.

Dr. Joseph Echtman (New York): I did not hear Dr. Levant's entire paper. I wish to ask him why in his last case he picked on lithium. He could have tried the positive pole without the medication and might have obtained the same result.

*Physical therapy in Bell's palsy may and should be started early in spite of the fact that some practitioners like Weisenberg and Halpern believe that in Bell's palsy care must be taken that treatment is not started too soon because the nerve in the early stages is inflamed and physical therapy may therefore do harm. I, however, believe, judging from my many years experience, that early treatment is very important. I have employed diathermy, and in many cases that presented themselves on the first or second day, I have had astonishing results. One case, a woman of 48, who came on the first day of the trouble was cured in 4 days. Treatments were given daily. Another case, a male of 26, referred by Dr. Iovino of New York, was cured with 9 treatments given daily.

One patient, a woman of 60, was cured in 14-15 treatments, etc.

Sampson states that the rapidity with which facial paralysis can be cleared up depends upon the cause and the time which has elapsed since the onset. The most of these cases are from thermal, and infective sources and may be cleared up in 10 days or so, if treatment is started the first or second day. After this condition has had more than two days start, it is harder to clear up. He also asserts that sedative diathermy is the best means of treatment. Diathermy in peripheral neuritis is also advocated by many others including Cumberbatch. Discussing peripheral neuritis, Cumberbatch states that relying on his experience of many years he prefers to use diathermy for the treatment of painful neuritis and has obtained a larger proportion of successful results by diathermy than by other forms of physical therapy.

* This represents Dr. Echtman's discussion on another paper presented the same evening on Bell's Palsy.

However, if there is reason to believe that the nerve within the canal is involved (and this can be easily judged: When the nerve within the canal is involved, the sense of taste in the anterior part of the tongue on the affected side is also affected and, if the nerve outside the skull is affected, the sense of taste is not affected), infrared and not diathermy should be employed at first for obvious reasons. It is also suggested that in Bell's palsy where the nerve in the canal is involved, there is an acute otitis media and the pain is then increased. Humphries assures us that for pain due to ear condition without apparent cause, the infrared, according to his experience, acts as a specific. In my cases above cited the nerve outside of the skull was affected. I applied the electrodes to the face; the active one, shaped as the patient's mandible, placed as close to the ear and as high above the zygomatic arch as possible thus covering the mandibular, buccal, zygomatic, and (part of) the temporal nerves which are usually affected.

I have never noticed that diathermy in facial neuritis should do harm or cause pain to the patient, though in the treatment of neuritis, brachial, sciatic, etc., patients have complained of pain during or after a diathermy treatment. The cause of the pain is not well understood, but I feel that it is not due to the physiologic process created by the diathermy treatment, i. e., increase of exudate, hyperemia, etc. For, I have noticed that, if the distance between the electrodes including the portion of nerve is relatively long,

pain may be experienced by the patient. For instance, the usual method of employing diathermy in brachial neuritis is as follows: One electrode is placed at the region of the formation of the brachial plexus, namely, at 5, 6, 7, 8 cervical and first thoracic and the inactive electrode consists of a pyrex basin in which the hand (fingers and palm) is placed. The distance between the electrodes is rather long and the patients thus treated have experienced pain during or after the treatment. In the method which I have instituted and have employed for years, the electrodes are brought as close to one another as possible. The active electrode is placed as mentioned above. The inactive electrode consists of half or full cuff of large size applied to the arm in such a way that its upper border is about 3-4 inches below the lower border of the tendon of pectoralis-major. This method, while it is, I believe, the best for this condition seldom if ever causes pain to the patient. The same I have observed in sciatic neuritis. The three cord method employed by Kowarschik and described by Cumberbatch causes less pain than the two cord method when the same portion of nerve is included.

From my careful observations, I concluded that diathermy properly administered in any stage of neuritis is not only harmless but is beneficial, especially so in Bell's palsy. Let us hope that the medical profession will not be misled by statements not verified by actual experience and will cooperate with the physical therapist by referring Bell's palsy cases as early as possible.

ROENTGENOGRAPHIC STUDIES OF THE COLON WITH DOUBLE CONTRAST ENEMA *

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PHILADELPHIA

The usual barium sulphate enema has shortcomings well recognized by roentgenologists. Filling defects due to retained fecal material, inseparable loops due to redundancies and reduplications, irritability and spasm invoked by the heavy barium column, are all annoying occurrences presenting considerable difficulty in differential diagnosis. To overcome these obstacles, successful resort may be had to the double contrast enema, using it as a final step after the ordinary barium enema examination. Then there are additional advantages to the double contrast enema, in themselves sufficient to warrant its more general use.

* Read at the Thirteenth Annual Session of the American Congress of Physical Therapy, Philadelphia, September 11, 1934.

Technic and Appraisal

The patient reports for examination without preliminary preparation. The usual single contrast barium enema studies are made. The patient evacuates naturally, taking time to expel all the contents possible. Roentgenoscopic studies are then made and the essential findings recorded on films. Many valuable observations can be made at this stage. Sometimes films are made with the patient in the erect position, especially when mobility of segments is in question. Following this, air is inflated into the colon using a Politzer bag of 250 cc. capacity and a ball valve mechanism in the bag to prevent reflux of contents. The inflation is done under roentgenoscopic con-

trol, the colon filled, but not distended. To effect this, it should never take more air than the opaque contents used in the single contrast enema. It usually takes about 1,000 cc. to fill the average colon and, knowing the capacity of the Politzer bag, a check is afforded on the amount of air inflated. In using this method for over five years, I have never met with any untoward effects, so that this technic can be safely recommended.

The normal colon is usually thoroughly evacuated of the opaque contents if the patient takes sufficient time. A small residue sometimes remains in the ascending segment, pelvic flexure, and rectum if evacuation has been hurried. Residues above this amount are possibly to be regarded as unusual and indicate somewhat the degree of abnormal motor activity of the colon.

When residues are present, inflation of air is carried out just the same, but less air is used and films are made with the use of horizontally directed x-rays, with the patient in the erect or one of the lateral recumbent positions. Records of fluid levels are thus obtained and these are found very helpful for diagnosis. The normal mucosa of the colon in the segments where evacuation has been good, has a thin uniform residue of barium suspension on it, resulting in a sharp thin, white line on the colonic margins and a uniform grayish white coating of the mucosal surfaces. Any changes in this appearance suggest abnormal secretions or excretions of a hyperactive, dysfunctioning, or inflamed mucosa.

Filling defects visible in the single contrast films, especially in the cecum, are very annoying. Even with elaborate preliminary cleansing preparation, of which many methods are in vogue, varying with different roentgenologists, one is never certain whether these defects are due to insufficient barium mixture, spasm, retained fecal material or neoplasm. The use of the double contrast technic eliminates these troublesome complications. If the defect remains the same in the single and double contrast films, then it may be regarded as real. The single contrast enema in itself is a good cleansing lavage, particularly since it is carried out under roentgenoscopic control. If, therefore, a defect is again visible in the double contrast films, it is usually due to no artefact or retained fecal material.

Redundancies and reduplications of the

colon can mostly be well studied with the simple barium enema if the patient is rotated into various planes. When the redundancies are marked and the lumen of the colon is considerably increased, it is sometimes impossible to study them all, no matter how much rotation is made. It is in this group of cases that the double contrast films are very helpful. The outlines of every loop, no matter how many superimposed reduplications may be present, can be easily seen through the columns of radiolucent air contained in the colon. This can be done entirely without extended roentgenoscopic studies and recorded on a single film. If much residue is present, the film is made with horizontal x-rays and the fluid levels thus recorded aid in distinguishing one loop from another.

Colitis, that is, genuine colitis, may be difficult to differentiate from so-called spastic colitis or irritable colon, with only the simple barium enema. Here again, one can use the double contrast films to good advantage. The coating of barium on the normal mucosa is smooth and uniform. If there is excessive secretion of mucus, the residual barium deposit is mixed with the secretions and is distributed unevenly and irregularly with these secretions. If the mucosa is actually inflamed, the barium residue shows a marked tendency to be washed away completely from the inflamed surfaces. These inflamed areas or segments, devoid of a barium coating, show up in marked contrast to the normal segments, which stand out nicely, etched by the thin uniform coating of barium deposit on the mucosa, contrasting sharply with the air beside it. When ulcers are present, one can rarely make out their outline by an irregular deposit of barium under or around the edges. In advanced ulcerative colitis, a stippled, pigskin-like appearance is noted on the barium coated mucosa due to secondary fibrous contractions. Secondary polypoid hyperplasia is very nicely demonstrable by the protrusion of this tissue into the air filled lumen of the colon; this demonstration is particularly revealing in the hyperplastic forms of ileocecal tuberculosis.

Ileocecal tuberculosis is easily diagnosed both in the early and late stages by the use of the double contrast enema. It has displaced the older, cumbersome but well developed progress meal method of Sampson in the routine studies of the intestinal tract of the tu-

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ARCHIVES of PHYSICAL THERAPY, X-RAY, RADIUM

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EDITORIALS

FACTS AND FADS OF CANCER THERAPY

Eradication of human cancer is still a problem of the future, for in spite of the marshalled forces of science, medicine and sanitation cancer is statistically on the increase. The story of the struggle of science with the daily recurring tragedies in homes gripped by the morbid experience of loved ones and bread winners slowly disintegrating under the horrors of pain, obnoxious odors and starvation to final dissolution is a picture so dramatic as to have left a dreaded impress upon the mind of modern civilization. In the absence of specifics, medical science has been forced to call upon all of its strategic methods to cope with this threat to humanity.

The present century will go down into history as one that had organized every available force for the study and control of the cancer problem. The laboratory, press and pulpit have become a co-operative defensive-offensive unit to protect, stem, and eradicate this menace from our civilization. An informative writer on this subject, Tobey,⁽¹⁾ has pointed out —

No one ignorant of cancer is safe from it. No one familiar with all aspects of the disease need ever fear it. In no other known malady is a com-

plete understanding of it such an absolute necessity, because cancer is always a personal matter, a purely individual ailment. Knowledge means power in the conquest of cancer, a sage proposition . . . resulting from experience in public health and sanitation.

As a result of intensive, well directed, organized and authentic information, the fantastic misconceptions of the lay world regarding cancer have been materially modified and directed towards scientific channels for treatment. The medical profession in particular has become more conscious of its responsibilities and its objectives. There is now general agreement as to the antiquity and nature of cancer, and the therapeutic possibilities of the resources at our command. Two avenues of great practical value have been pointed out. While specific eradication is as yet an impossibility, prevention and reduction of morbidity by the educational facilities of the press and pulpit have already, as they will even more in the future, aided in reducing the situation from a hopeless to a more promising one.

There is general accord among all scientific bodies that our therapeutic and diagnostic resources are sound although hardly as brilliant as the needs demand. According to Bloodgood,⁽²⁾ there are no specific

cures for cancer except operative intervention by competent surgeons, irradiation with radium or x-ray by expert radiotherapists. This conservative and rational viewpoint has been repeatedly stressed at our annual sessions and in the pages of the ARCHIVES. Through these transactions an important orientation has been contributed; namely, the value of electrosurgery for removal of malignant neoplasms. This, while insuring a much sought protective zone against cellular invasion of adjacent structures during operative intervention, has by no means solved the major problem — its complete elimination.

Our difficulties have not been limited to therapeutic procedures. Recognition and differentiation of incipient growths and their grouping have been the objective of our profession. It is far more important for the weal of mankind to recognize the bud rather than the full bloom of cancer. The ingenuity of science coupled with special experience has provided a new aid in the conflict of medicine with cancer. Specially trained microscopists, pathologists and serologists have now become a select group who pass upon mooted borderline types and adjudicate the material on tangible evidence. Bloodgood⁽²⁾ has pointed out —

Cancer, or lesions that precede cancer, or diseases which may be confused with cancer can no longer be dealt with properly by a single individual. In the diagnosis of local lesions that may be cancer there must be a surgeon, a radiotherapist, and a pathologist. When the radiotherapist is not trained in x-ray diagnosis, such a trained radiologist must be added to the medical unit.

Unfortunately, where experiences are still in the formative stage and where important subject matter has not been crystallized to the stage of dogmatic acceptance, evanescent opinions compete with fundamental facts, the wish becomes father to the thought, and readily finds disciples who are not competent to distinguish facts from fads. What an indictment of intelligent and scientific education that all cures of cancer have been discovered by lay individuals, and by those on the fringe of scientific medicine! Each period has had its Perkins and tractors, its Abrams and electronics, its Koch and "concoctions," all falling upon our startled consciousness like meteors passing in the night. Well wishing

theorists and mystics have not only often mistaken causal relationships for cures but have been deluded by reasoning more metaphysical than physical.

The Congress has been born and motivated by a desire to render its share of service to the advancement of cancer therapy along rational lines. For this very reason the Congress disavows any theoretic concept or such based upon a few scattered and uncontrolled observations that tend to suggest a discovery of a so-called cure even though promulgated in our own midst. Not infrequently such pretended cures are clothed in a technical verbiage suggestive of profound study that will not stand critical investigation. The medical profession must be aware that in our present stage of knowledge any attempt to proclaim a cure through to the lay press is *ipso facto* an appeal to credulity. Until authoritative bodies have acknowledged through exhaustive tests a real discovery, the profession and the lay world will do well to consider every individual announcement with the utmost scepticism.

References

1. Tobey, James A.: Cancer, What Everyone Should Know About It. New York, Alfred A. Knopf, 1932, p. vii.
2. *Ibid*, Bloodgood, J. C.: Introduction p. xxv.

THE FOURTEENTH ANNUAL SESSION

The fourteenth annual session of the American Congress of Physical Therapy was held in Kansas City, Missouri, from the 9th to the 13th of September. In keeping with the policy of the Congress to hold annual sessions in widely separated cities so as to reach the profession in as many medical centers as possible, this year's selection has been a strategic one. From the beginning to the end of this session many physicians residing in communities on both sides of the Missouri river have not only attended as interested visitors but by their own testimony left the convention impressed with the progress of physical medicine. Representatives of various medical schools and hospitals throughout the country, as well as the Jackson County Medical Society not only attended the convention but took an active part in its deliberations. Physical therapy has beyond doubt secured a firmer foothold in the middle west through the

contributions which have been announced in the program for this session.

The fourteenth annual session differed in many respects from the preceding annual conventions of the Congress. The course of instruction held before the regular convention was successful beyond anticipation, not only from a numerical standpoint of the participants but from the value of the information conveyed to the numerous physicians and technicians in search of post-graduate work. Every moment was filled with lectures and demonstrations by the best available instructors. Even the lunch hours were utilized for the informal discussion of moot problems. The Congress owes a debt of gratitude to the distinguished colleagues who have unsparingly given of their time and energy to bring home important facts to clinical workers. The subject matter, which has been published in the program, was treated not at all in an elementary manner because the participants were known to have been engaged in the practice of physical therapy for some time. As a matter of fact the instructors adapted their respective lectures or demonstrations to the needs of all. At the conclusion each participant was handed a questionnaire with the request to offer criticisms and suggestions for future guidance. It was suggested that the questionnaires should not be signed to insure full freedom of expression. It is gratifying to state that the course has received the enthusiastic endorsement of the class as a valuable means of instruction, so much so, that it is planned to repeat this enterprise at some future annual convention. As was announced, Dr. Franz Nagelschmidt, formerly of Berlin and now of London, came to Kansas City in time to open the course of instruction in which this internationally known pioneer in electrotherapy took a leading share. Nagelschmidt brought to the Congress as well as to the instruction class information based on his own original researches. The Congress is indebted to the men and women who have contributed to the success of this teaching enterprise.

An idea of the attendance can be had from the registration, which exceeded five hundred. Fortunately the hotel accommodations were ample for the general and sectional meetings

and for the extensive scientific and technical exhibits. Considering that physical therapy is, at least in its present advanced state, a comparatively young branch of medical science, the large attendance evidences an increasing interest of the profession in the development and efficacy of physical therapeutic procedures.

The scientific program having been published in the ARCHIVES, we need not enter here into its details. Suffice it to say that the symposia, individual papers and the manifold forenoon conferences in the several sections were almost without exception of a high scientific standard. The consensus of opinion of many members who have regularly attended the annual sessions, was that the fourteenth session has reflected a greater unity between experimental and clinical physical therapy, a status of concrete value to general practitioners as well as specialists. This has been manifest also in the scientific exhibits. The Council on Physical Therapy of the American Medical Association, represented by its secretary, Mr. Carter, contributed much invaluable material and provided a large number of practical demonstrations in addition to studies of certain physical problems. The Congress expresses its sincere appreciation to the Council and its representative for their co-operative efforts in behalf of scientific physical therapy.

A large section of the exhibit hall was given over to individual scientific exhibits. Their character is best described by the statement that the Jury of Awards frankly confessed that after careful study it found itself confronted by a difficult task in selecting those meriting the three graded prizes, and that it had to reach some compromise but not without first demanding that prizes in the form of certificates of merit be added.

As has been customary for some time, the Congress selected an outstanding authority to deliver the William Benham Snow memorial lecture. This year's lecturer, Arthur Steindler, discussed the physical properties of bone in a manner which demonstrated scientific attainments of surgical research. Dr. Steindler's paper will be published in the ARCHIVES in the near future. Fantus addressed the Congress at its joint

session with the Jackson County Medical Society. As it appears elsewhere in this issue we need only refer the reader to it without further comment.

The President's dinner proved an enjoyable as well as impressive event. With Hibben acting as toastmaster one was sure that those he had selected to give brief addresses would be properly introduced. Fouts, of Omaha, presented the citations of the American and foreign savants on whom the Congress bestowed this year's highest award for meritorious service to physical medicine, and the awards for scientific exhibits. Nagelschmidt presented greetings from abroad, which were extended on behalf of the local profession by the dean of the medical school. Apart from these customary and more or less formal talks the audience obtained an interesting picture when General Blech, of Chicago, gave brief but vivid experiences with physical therapy in surgery. He narrated his own investigations for the past thirty years, both in peace and war surgery, and pointed out the tremendous influence of physical therapy not only in human conservation but in surgical conservation. Other speakers were Carter, King, Tyler, and Wahl. The distinguished dermatologist, Sutton, concluded the dinner program with a highly interesting, illustrated travelogue.

The administrative and educational features affecting the Congress were considered in the customary business sessions and in the final conference. Hollender presented a report on the diverse activities of the executive office and of the several standing committees of the Congress. A satisfactory financial status was reported by Coulter, as treasurer. Kobak gave an account of the work in connection with the publication of the ARCHIVES, whose success he ascribed to the co-operation of Hollender as managing editor, to the Publication Committee for their individual and collective support of his editorial policies, and to General Blech for his handling of the foreign literature.

President-elect Bierman, of New York, presented a report on the Registry of Technicians. This subject aroused a serious discussion with the result that definite plans were formulated which, it is believed, will prove satisfactory to the technicians as well

as the Congress. Kobak, as editor of the ARCHIVES, presented at the last conference an exhaustive survey of the present state of education and literature. He stressed the advances made both here and abroad and explained to the assembled educators and authors the vital need of full and continued co-operation between the Congress and the American Medical Association to safeguard the profession as well as the public against unscrupulous commercialism and charlatanery. There can be no doubt from what has been said that the fourteenth annual session has gone down into history as a worthy successor of all preceding conventions of the American Congress of Physical Therapy.

AWARDS OF MERIT BY THE AMERICAN CONGRESS OF PHYSICAL THERAPY FOR THE YEAR 1935

The American Congress of Physical Therapy represents a body of American physicians and surgeons dedicated to the highest attainable advancement in the research and the practice of Physical Medicine. Ever anxious to further in every ethical and legitimate way the clinical benefits of Physical Therapy as the supreme and ultimate goal of our scientific



endeavor, the Congress is desirous not only of stimulating every form of scientific research that may contribute towards the attainment of this goal, but of spiritually and materially giving expression of appreciation of outstanding labors and beneficial achievements, past and present, to the individuals meriting such recognition. The highest honor within the power of the Congress to bestow for such exceptional merit is the Gold Key, which for the past few years has been awarded to several men both here in America and in foreign lands.

The Board of Governors has unanimously bestowed this privilege on the following five

men representing the United States, Germany, Turkey, France, and Switzerland. Their names and official citations follow:

Friedrich Dessauer. Distinguished Son of Germany, now laboring in Istanbul, Turkey. Discoverer of the point heat theory of the x-rays. Eminent electro- and roentgen physicist. Teacher of international renown.

Joel Ernest Goldthwait. Distinguished Son of Massachusetts. Brigadier General, United States Army. Distinguished service medalist. Pioneer in the bio-kinetics of orthopedic deformities. Eminent orthopedic surgeon. Army Medical Officer whose teachings contributed to the health and physical development of our troops. Author of scientific works on orthopedics.

Stephan Leduc. Distinguished Son of France. Pioneer in electrophysiology. Discoverer of the Leduc current. Author and teacher, whose labors have greatly contributed to the development of modern electrotherapy.

A. Rollier. Distinguished Son of Switzerland. Pioneer in the helio-climatotherapy of surgical tuberculosis. Author of international fame on the conservative physical therapy of medical and surgical tuberculosis. Successful clinician whose labors have been as effective in the cure of tuberculous patients as they have influenced the general concept of natural means in the therapy of surgical tuberculosis.

Joseph W. Schereschewsky. Distinguished Son of Massachusetts. Officer of the United States Public Health Service. Pioneer investigator of the influence of short wave radiation on the human body. Sanitarian and electrophysiologist of international distinction. Author of scientific contributions in the domain of electrophysiology.

Willis R. Whitney. Distinguished Son of New York. In charge of the Research Division of the General Electric Company. One of the first discoverers of the distant heat effect of short wave radiation. Indefatigable worker in the field of electrophysics and enthusiastic researcher in the domain of electrophysiology. Author of more than national reputation. Ardent cooperator in research of hyperpyrexia therapy.

AWARDS FOR SCIENTIFIC EXHIBITS

At the convention held in September in Kansas City, the Jury of Awards after careful and impartial study of the individual scientific exhibits reported on the best presentations. The first prize—gold medal—was awarded for a study of the influence of temperature raised by means of drugs and physical agents on the human organism.

The second prize—silver medal—was awarded for an exhibit of moulages and charts of external malignant growths.

The third prize—bronze medal—was awarded for a graphic exhibit of Volkmann's contracture.

Honorable mention was awarded to exhibits dealing with the physiologic effects of acetyl-beta methyl choline chloride; and, too, studies of the bio-mechanic action on fibrous tissues which included microscopic slides and photomicrographs showing the histology of fibrous tissues, anatomical photographs and x-rays showing their clinical application.

The winners are as follows:

First Prize: *William Bierman*, M.D., New York.

Second Prize: *Lester Hollander*, M.D., Pittsburgh, Penna.

Third Prize: *Henry W. Meyerding*, M.D., Rochester, Minn.

Honorable Mention: *A. J. Kotkis*, M.D., St. Louis, Mo.; *Charles M. Gratz*, M.D., New York.

NEW OFFICERS 1935

The American Congress of Physical Therapy wishes to announce the following as officers for the coming year:

President, John Severy Hibben, M.D., Pasadena;

President-Elect: William Bierman, M.D., New York;

First Vice-President: Frederick L. Wahrer, M.D., Marshalltown, Iowa;

Second Vice-President: Frank H. Krusen, M.D., Rochester, Minn.;

Third Vice-President: Grant E. Ward, M.D., Baltimore;

Fourth Vice-President: W. J. Egan, Milwaukee, Wis.;

Secretary: Nathan H. Polmer, M.D.,
New Orleans;

Treasurer: John S. Coulter, M.D., Chi-
cago.

MEETING PLACE FOR 1936 SESSION

At the recent session in Kansas City, New York City was selected as the place for the 1936, or Fifteenth Annual Session. The dates chosen were September 14, 15, 16 and 17.

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berculous at Eagleville Sanatorium. The mottled irregular coating of barium residue on the inflamed ileocecal mucosa is so nicely demonstrated in the early stages of tuberculosis on the double contrast films that by it, a diagnosis can be made without symptoms of spasticity, irritability, hypermotility, pain and tenderness, findings also obtainable in the single contrast studies. In the late stages of ileocecal tuberculosis, the contractions of the lumen and the ulcerated, ragged, shaggy mucosa are visualized more definitely in the double than in the single contrast films.

Diverticula of the colon are demonstrable in the simple enema films, but only so on the outside of either margin. In the double contrast films diverticula can be seen on all surfaces through the air in the colon. It is surprising how greatly increased the number is, one sees in these films. If any diverticula or segments of colon bearing them are at the same time inflamed, one encounters the irregularity and unevenness in distribution of the barium on the inflamed surfaces, so characteristic of these changes.

Neoplasms are the pathological processes warranting most the routine use of the double contrast enema; not in the last stages, but in the earliest phases. In the late stages with some degree of obstruction, the single contrast enema better demonstrates the lesion. In the early stages, long before obstruction develops, one can see small growths in the air column of the colon, which are occluded in the single contrast films by the enveloping column of opaque barium mixture. Omission of

the double contrast enema study should never be allowed in a case of unexplained blood in the stools, whether it be macroscopic or occult. It is remarkable the number of cases with polyps, adenomata, other small benign bleeding growths, and early malignant neoplasms that can be found with the double contrast method, in which the single contrast enema completely fails.

Discussion

Recognition of the densities and changes of barium coating on the colonic mucosa indicative of underlying pathology in the double contrast films requires practice and experience. It will be found to prolong the older simple barium enema study and to be somewhat more troublesome till one gets familiar with the technic. Case after case will be studied where this additional examination will yield no extra information. But with persistence one soon learns to detect so much additional valuable information and practice with the technic, and soon makes the study so simple and short, that its routine use is never varied. When finally one discerns an early neoplasm, not seen or suspected in the single contrast films, one feels compensated for the effort expended in becoming acquainted with the method.

Summary

The double contrast enema is described. The technic of its use is reviewed, and an appraisal is made of its usefulness in the various conditions of the colon usually studied by the ordinary barium enema.

Medical Tower.

THE STUDENT'S LIBRARY

PRÉCIS DE PHYSIQUE MÉDICALE. By André Strohl, Professeur de Physique Médicale, à la Faculté de Médecine de Paris; Membre de l'Académie de Médecine, Paris. Pp. 723. Price, 70 francs. Paris, Masson et Cie, Editeurs, Libraires de l'Académie de Médecine. 1935.

The author has attempted to bring together in a single volume the various laws of physics, chemistry and allied sciences related to medicine. The reciprocal contributions made by physicist and physician to bring about a better understanding of bodily functions is sensed by the reader. Simplicity without sacrifice of detail is the characteristic of this work. Its chief value, however, does not lie as much in the presentation of new facts as in the gathering together of the most important facts frequently needed and for which one usually has to consult many volumes and much heterogeneous material. It is pleasingly down to date. The volume is divided into six sections each dealing fully with one particular field. Section one treats manifestations of the various forms of chemical, thermal, and mechanical energy. A whole chapter is devoted to the laws dealing with the transformation and conservation of energy. Another discusses muscle physiology, the muscle being compared with an electric motor. The second section deals with acoustics, while the third contains a thorough discussion of physico-chemistry. The laws of gases are reviewed with their application. One will find the expositions of viscosity, surface and capillary tension, and the optical properties of liquids particularly helpful. Chapters on solutions and colloids are excellent, but especially valuable is the evaluation of ionization. Its possibilities and limitations are well presented. The section on light is divided into three parts. It deals with optics as related to vision and gives the natural and artificial sources of light. The photometric laws, some of which are vitally important to those using radiations of any kind are fully discussed. Another chapter takes up the biologic action of light. The author discusses the absorption of light of different wavelengths as well as the action of light on ergosterol. Another one is devoted to the antagonistic action of ultraviolet and infrared rays. The absorption of infrared of different wavelengths by the skin is carefully considered. The tungsten filament, nitrogen filled bulb is given as the best artificial source of infrared. The fifth section is entitled "Electrophysiology; Electrotherapy." Strohl first deals with the fundamental laws of electricity, and the conduction of electric currents in the human body. He emphasizes the important rôle of tissue resistance in the technical application of current. This particular chapter is indeed timely. The use of muscle and nerve stimulation by the galvanic, faradic, and static currents is discussed. It is regrettable that foreign authors have so little appre-

ciation of the sinusoidal current which is perhaps explainable by their greater use of condenser methods for chronaxia, which is discussed in a separate chapter. To those interested in this subject a chapter dealing with the old and newer methods of electrodiagnosis will prove valuable. A few chapters consider the high frequency currents. The early standard type of a spark gap generator is discussed as well as the latest in the ultrahigh frequency field. Accidents produced by electric currents conclude the section. The sixth and final section takes up radiology. The physical laws and absorption of radiation are reviewed. The technic of radiology and the principles of radiotherapy are fully expounded. A whole section is given up to radium therapy. The final chapters discuss the dangers of x-ray, radium and the methods of protection. The work must be regarded as one of the best contributions in its field and is of especial value to students of physical therapy.

ABSTRACTS OF PAPERS AND DISCUSSIONS. Fifth Annual Fever Conference, Dayton, Ohio. Edited by *Walter E. Simpson, M.D.*, Pathologist and Director of the Kettering Foundation for Fever Therapy, Miami Valley Hospital, Dayton, Pp. 123, Boards. Price, \$1.50. Dayton, Ohio: The Miami Valley Hospital, Publishers, 1935.

This volume represents a laborious effort, usually termed "a labor of love," on the part of a single individual, whose contributions to fever therapy have marked him as outstanding in this field. The fifth annual fever conference was recently held at Dayton under the auspices of the Miami Valley Hospital staff and under the inspirational leadership of Simpson. The transactions in mimeograph represent the editorial efforts of this individual to give literary permanency to discussions and contributions of scientific value. The report contains forty different papers and many more discussions on laboratory and clinical observations on the effects of artificially induced fever. The editor has rendered great service to contemporary medicine by epitomizing the large material without sacrificing any basic conclusions of the authors. For example, such an important study as the thermal death time of 130 strains of gonococci has been summarized in the space of eight lines; and the report on the basic cure of gonococcal infections with a single hyperpyrexia treatment, in ten lines. The volume includes reports and extremely informative discussions on perhaps the widest field yet covered by students of this therapy. It includes contributions on the combined value of electropyrrexia and tryparsimides for general paresis; the treatment of gonococcal infections of the female by combined systemic and local heating; demonstration of electrocardiographic changes encountered in artificially induced fever states; the influence on

chloride and water metabolism in artificial fever; the pathologic changes seen with accurate control of fever; artificial fever therapy of syphilis; and other papers of equal interest and importance. One closes this volume with a conviction that artificial fever therapy is undoubtedly an important contribution to medicine, and the abstracted reports the most significant index of their conservative and critical evaluation of controllable hyperpyrexia for many hopeless affections. This book should be in the hands of every progressive student of medicine.

FUSSBESCHWERDEN UND IHRE BEHANDLUNG (Foot Troubles and Their Treatment). By Dr. *Max Schotte*, Privatdozent University of Hamburg. Second, completely revised and enlarged edition. Pp. 164 with 68 illustrations and 13 plates. Price (cloth edition) 8 marks. Vienna: Wilhelm Maudrich, 1935. (American Agency: Chicago Medical Book Co., Chicago.)

Seldom has there been published a practical book which merits greater appreciation on the part of the general medical profession than this small and inexpensive volume. In fact this work should have a special appeal to physicians interested in physical therapy. As the author himself points out we have left chiropodists to do work which not only properly belongs to physicians but which only physicians with their better training can treat competently. We are in accord with him that chiropodists should restrict themselves to the removal of minor troubles, such as corns and calluses, but not undertake the correction of certain foot deformities or abnormalities. On the other hand the author points out that even orthopedic surgeons have failed to relieve many patients because of certain false conceptions and thereby drove many dissatisfied to a class of men who are abroad the counterpart of our self-styled "foot specialists". The *leitmotif* of the text is the utter condemnation of the sole inlays which are neither anatomically correct nor effective. Admitting that now and then some patients are symptomatically improved, the author maintains that this is inadequate. The ideal is not relief of symptoms but correction of deformity. Himself a sufferer, the author has sought a cure with the best trained specialists only to be disappointed. This led him to a thorough study of the causes of a number of foot troubles and he developed the theory that in the majority of instances the pathologic characteristic is not to be sought in the arch but in the heel. Gradually he developed a soft wood "inlay" to support the sustentaculum tali. It is built on sound anatomic principles. While we have no personal familiarity with the author's method, he has tried it on more than 3000 patients with eminently satisfactory results.

The text proper opens with a practical study of the anatomy and physiology of the foot. This is followed by a brief chapter devoted to a definition of "foot troubles". In a subsequent chapter Schotte reviews the usual methods in vogue and provides a minute description of his "corrective heel-ball support". He also shows proper ways of measur-

ing the length of the heel and of obtaining prints of the soles. Massage and resistance gymnastics are discussed. These must be carried out under the physician's supervision. The remainder of the book is devoted to a very interesting study of a variety of foot abnormalities and their complications. He is a firm believer that certain deformities affect the entire human economy. Equally important are his studies dealing with varicose veins, ulcers of the leg, the algias and arthritides. A number of clinical cases are given for purpose of illustrating the diagnosis and the effects of proper therapy. He includes brief discussions of "thick legs" of the painful knees of fat women, and the influence of poor circulation of the foot on the activity of the heart. A critical review of the whole problem concludes the volume, which has quite a bibliography but—as usual—lacks an index.

The book is typical of the Maudrich publications—thick glossy paper, excellent type and clear photographic illustrations.

DICTIONARY OF FOREIGN TERMS. By *C. O. Sylvester Mawson*, Litt.D., Ph.D. Cloth. Pp. 389. Price, \$2.00. New York: Thomas Y. Crowell Company, 1934.

This is a work of special appeal to the *literati* and to the increasing group of specialistic readers who need aid in clarifying some obscure expression of foreign origin. The intermixture of foreign terms in our language is today so apparent that ready comprehension involves an education beyond the reach of the average individual. Dr. Mawson has therefore rendered an outstanding service by collecting under one cover the words and phrases from no less than fifty-six languages, altogether about eleven thousand entries, each translated and even explained in full. It is really a multiple dictionary consisting of quotations, proverbs, mottoes, menu terms, Orientalisms, Americanisms, and a rich collection of foreign expressions reduced to modern meanings, many of them being recorded here for the first time in any English book of reference. The work is a labor of highest scholarship and practicality and actually fills a much needed place in the world of letters—literature, periodicals, and the daily press. While on the surface the average American professes an outward contempt and "pitying tolerance" for foreignisms, actually on the subsurface of our thoughts, we are much given to expressions culled from many languages. Indeed, the whole world has become cosmopolitan in thought as well as polyglot in our intellectual pursuits and it is comforting to realize that in times of pressing need we shall be well served by such a polyglot and discriminating source of information. The material incorporated in this dictionary is the substance seldom enlarged upon by average books catering to the literary tastes of the individual, and hence is of special value as a useful and also authoritative reference for educational purposes. The book is reasonably priced and worth double the money to any person of an inquiring mind, hence it is especially recommended for one's library.

INTERNATIONAL ABSTRACTS

Short Wave Therapy of Articular Disturbances. E. Last.

Med. Klin. 31:342 (Mar. 15) 1935.

Last states that in treating articular inflammation with short wave therapy, he always chose a dosage that the patient felt as a pleasant sensation of heat. In chronic cases, however, a dosage was used that would heat the joints thoroughly. The author never observed burns or other impairments that could be ascribed to excessive dosage. He employed a tube apparatus that could be set for any wavelength between 4 and 15 meters and also a spark-gap apparatus that produced wavelengths of about 7 meters. He refrains from a definite evaluation of the two types of apparatus but emphasizes that only those types should be used which, while producing short wavelengths, permit the use of great energy in order to produce the necessary depth action within the joint. He concludes that short wave therapy is a valuable addition to the therapeutic armamentarium of articular disorders but admits that, like other treatments, it fails occasionally. The rapid disappearance of pain frequently permits the earlier application of a more active therapy. Repeated roentgenologic control examinations disclosed that existing anatomic changes in the joints were not influenced by short wave therapy. In florid tuberculous processes of the joints, short wave therapy is inadvisable. — [Abstr. J. A. M. A. 104: 1867, (May 18) 1935].

Artificial Fever Therapy in the Treatment of Corneal Ulcer and Acute Iritis. E. L. Whitney. J. A. M. A. 104:1794 (May 18) 1935.

Ophthalmologists for over twenty years have used nonspecific proteins in the treatment of certain eye diseases. The height of fever produced has served, at least in part, as a guide to the reaction. In the use of typhoid vaccine, Howard noted several years ago that fever was essential to a good result. In the last year the author had opportunity to use artificial fever alone as a means of therapy in a sufficient number of eye conditions to warrant reporting the results thereby obtained.

Kettering hypertherm machines were installed more than a year ago in our clinic for experimental work in the treatment of syphilis (principally neurosyphilis) multiple sclerosis, gonorrhea, pelvic peritonitis and arthritis. This apparatus consists of an air conditioned cabinet with which the patient's temperature can be elevated rapidly and maintained at a desired level and carefully controlled for an extended period of time. The entire body, excepting the head, is placed in the cabinet. Mild sedatives are used

to keep the patient as comfortable as possible. An electric fan cools the head.

Eight cases presenting varying types of corneal ulcer and six cases of acute iritis are here reported. The results suggest that there is merit in this form of fever therapy, in which the height of the fever and its duration are under such perfect control. Some of the patients received different types of medication during the fever treatment as well as before, while others had fever therapy only.

Prompt healing of some corneal ulcers after fever therapy is a striking fact. Local treatment is quite adequate in many cases, but fever treatment has hastened healing when local measures have seemed to be making little progress. This is particularly true in cases in which systemic stimulation is indicated. The production of artificial fever in acute iritis is of definite value. Recovery is hastened. Further observation is necessary to determine the effect it has in preventing recurrences.

Treatment of Frost Bites With Short Waves. (Behandlung von Erfrierungen mit Kurzwellen.) Bürkmann.

Dermat. Wchschr. 98:622 (May) 1934.

The author reports some cases of frost bites he treated successfully with short waves. According to his concept frost bites of hands, feet and legs involve an infiltrative process as a reaction to a primary effect of cold. He applied a condenser electrode to a pad of medium softness, the frost bitten fingers or toes were placed upon it. If both hands or feet were affected they were placed crosswise. The other electrode was placed above the double layer of tissue to be irradiated and fixed by a rubber bandage which was placed over the first electrode. A light sand bag was then applied. Compression of tissue and local anemia must be avoided. With most of his cases the author inserted a felt pad of about a width of 5 mm. between the electrode and the skin in order to produce a more homogenous heating of the affected area. With this arrangement the current was turned on. Treatment was given for 15 minutes in the beginning, after an interval of 4-5 days another treatment of 20 minutes or in case of need 25 minutes was given. Six treatments constituted the average.

In heating the shaft the electrode was applied laterally inside and outside the lesion.

To apply heat to the nose, the patient is placed on a couch in a lateral position, the electrode by adequate padding from below is applied to one side of the nose, while the second electrode is placed on the other side of the nose and held by a light sand bag. To avoid connection between

both electrodes, a thin rubber tube is inserted between them.

Short wave treatment is preferable to all other methods, such as alternating cold and hot baths, painting with iodine-glycerine.

X-Ray Treatment of Carcinoma of the Pharynx.
(Ueber Röntgentherapie der Pharynx-Karzinome.) H. Coutard.

Strahlenther. 52:1 (Jan.) 1935.

The dosage of energy applied to the tissue amounted to 6,000-8,000 r, (measured at the skin). The average field was 75-125 cm². The tension came up to 200 K. V., 2 mm. Zn filter + 3 mm. Al. The distance between the focus and the skin ranged between 40 to 60 cm. In all cases of epithelioma cured by that method the underlying tissues were movable. Cases of carcinoma spread rapidly in loose connective tissue where the cells could multiply without resistance yet without losing sensitivity to rays. In case the carcinoma developed in more compact tissue revealing some infiltration of the muscular fascia, healing was the exception. Thorough infiltration of the muscles precluded healing.

The author stresses the question of dosage, which does not constitute an essential factor in the treatment of all cases of carcinoma. Increase of dosage in infiltrative carcinoma of the pharynx did by no means improve the curative results; on the contrary it increased considerably, injury to the skin and mucous membranes. A longer duration of exposure, however, considerably improved the results. When treating infiltrative epithelioma, time is of greatest importance and not dosage. Coutard is inclined to believe that a duration of irradiation of 25-30 days would prove successful in cases of epithelioma with very small infiltrations. In types of stronger infiltration 40 days seem to be a minimum; with complete muscular infiltration the treatment should last 50-60 days.

Endourethral Electrocoagulation of Hypertrophy of Prostate by Means of a Catheter Modified According to R. Vogel (Hamburg) and Some Remarks on Palliative Prostate Operations.
(Ueber die endourethrale Elektrokoagulation der Prostatahypertrophie und dem nach R. Vogel (Hamburg) modifizierten Katheter, mit einigen Bemerkungen über palliative Prostataoperationen.) Franz Best.

Ztschr. f. urol. Chir. 40:322 (Jan.) 1935.

When electrosurgery was developed operators recalled Bottini's method to burn a way through the enlarged gland. McCarthy's, Young's, and other methods made use for a similar operation of a cystoscope of special construction by which — under vision — they extirpated those parts of the gland which obstructed micturition. Another method was invented by Vogel. He modified Thiemann's catheter in such a way, that a ring of German silver (1 cm. wide) beneath the eye of catheter was applied, serving as an active electrode. The coagulation of the prostate was managed with careful flat-iron move-

ments (several times within half a minute). The author treated eight cases with endourethral electrocoagulation, only a few of which turned out successfully. The failures may be accounted for by the fact of a special type of nodulation with these patients. All types of prostatic hypertrophy are not suitable for electrocoagulation. This holds good most of all with cases revealing intense enlargement of the lateral lobes which shut like a valve the opening of the bladder.

Though results were not entirely satisfactory, the author still considers the method to be one of choice for any cases which on account of some contraindication are not suitable for a radical operation. Compared with other methods there is a great advantage in the simple instrument and absence of risk of the procedure. Considering the small number of cases and short period of observation, no definite opinion can be passed regarding a prolonged clinical cure. Electrocoagulation is not a substitute for prostatectomy.

The Management of Adhesions in Artificial Pneumothorax. J. W. Cutler.

Am. Rev. Tubercul. 30:416 (Oct.) 1934.

With the more widespread use of therapeutic pneumothorax in the treatment of pulmonary tuberculosis it would seem desirable to attempt to define the indications and contraindications for severing adhesions, to discuss methods of management, and to describe improved instruments and technic. The case histories and serial x-ray films of 200 consecutive patients in whom a pneumothorax could be established have been observed during the past four years.

The most useful advance in technic is the operating forceps-thoracoscope employing the vacuum tube high frequency machine as the source of electric current.

Adhesions were found in 173 or 86 per cent of 200 consecutive cases of pulmonary tuberculosis with a satisfactory space for artificial pneumothorax, in 36, or 18 per cent of the entire series, the adhesions were of such a nature as to prevent collapse, after allowing for the possibility of closing cavities by phrenic evulsion or scalenotomy, and by spontaneous stretching of adhesions.

In at least 27 more cases, or an additional 13.5 per cent of the 200 cases, pneumolysis, though not so urgently indicated, saved or would have saved the patient considerable invalidism and expense. Moreover, in many cases it was the safer form of management. Thus, in this series pneumolysis was considered as indicated in every third case suitable for pneumothorax therapy, to promote a surer and an earlier return to health.

Pneumolysis was essential to collapse cavities in 8 per cent of cases having string adhesions alone, in 11 per cent of those with band adhesions alone, in 37 per cent of those with apical cap adhesions alone, and in from 33 to 42 per cent of those with mixed adhesions, and was considered desirable though not essential in additional percentages. These figures more exactly indicate the frequency with which the operation

is indicated than figures based upon a given series treated by artificial pneumothorax, which will include various types of adhesions corresponding with the relative severity of the various cases included.

Results of Irradiating *Saccharomyces* with Monochromatic Ultraviolet Light. I. Morphological and Respiratory Changes. Robert H. Oster. *J. Gen. Physiol.* 18:71 (Sept. 20) 1934.

Effects of measured ultraviolet light on the yeast *S. cerevisiae* have been studied. Methods of culturing and irradiating the yeast, of estimating the nature and extent of the changes produced, and the means used in producing and measuring the radiation are given.

No evidence of a stimulative action was observed. The absorbed energy did not produce an all or none effect; arbitrary criteria must be used for judging the various inhibitory and lethal effects. With increase in the incident energy diverse effects were produced until abnormal cell growth and "death" of the cells resulted. Changes in the rate of oxygen consumption did not occur until after a high proportion of the irradiated cells were so damaged that they produced abnormal cells.

The shape of the curves relating effect to energy is similar for various wavelengths but different energies are required to produce the same effect at each of the wavelengths studied. The similarity of the curves to that for a first order reaction is noted, but attention is called to the modifying influence of accessory factors such as the age of the cells. A comparison is made of the morphological and metabolic changes on the basis of energy requirements, and their relative value as criteria in judging the effects of ultraviolet light on yeast and physiologically similar microorganisms.

Short Waves. (A propos des ondes courtes.) J. Saidman.

J. d. méd. d. Paris 54:260 (March) 1934.

Research with short waves established their specific, extrathermic effect as the relative lowness of the attained temperature does not account for the therapeutic results. The technic plays a principal rôle, considering the fact that by a change in the position of the electrodes or in the intensity of the electric field the desired success may become failures by the production of pains and spasms. By small dosage, accuracy of the field strength, and proper exposures, the author was very successful in treating neuritis, neuralgia, pains due to disturbances of the sympathetic nerve (angina pectoris, swallowing of air, Raynaud's disease, sciatica) fissure of anus, and hemorrhoids. The author emphasizes the decidedly entropic and euphoric effects in a number of asthenic conditions, due to liver or hormonal insufficiency. With the latter indication intensive dosage is needed in order to provoke artificial fever, while with hyperfunction of

the thyroid gland (Basedow's disease) smaller dosage is of benefit.

According to Nicolau's experiments bactericidal effects chiefly depend on correct application, since general exposure of rabbits which were vaccinated with typhoid bacilli produced but a small raise of the agglutinin titer, while local irradiation of the epigastric region did so to a considerable extent. The author suggests a combination of short waves with other methods of irradiation.

The Effect of Short Waves on Bacteria. (Die Einwirkung von Kurzwellen auf Bakterien.) Heinrich Lippelt, and Carl Heller.

Wiener klin. Wchnschr. 15:1745 (Dec.) 1934.

The effect of short waves of 4-8 m. on cultures of pneumococci, staphylococcus albus hemolyticus, streptococcus hemolyticus and bacterium coli commune has been studied by the authors. Pneumococcus and staphylococcus albus hemolyticus were inhibited in growth while staphylococcus hemolyticus did not show any effect. Bacterium coli commune revealed acceleration in growth when treated for a short time, while no influence was seen with treatment of longer duration. Consequently we must distinguish between bionegative and a biopositive effect of short waves, possibly due to different intensity of heating. For short wave treatment the wavelength, intensity of the field, and duration of treatment are important factors.

Therapeutic Possibilities of Fast Cathode Rays. (Aussichten und Möglichkeiten einer Therapie mit schnellen Kathodenstrahlen.) A. Brasch, and F. Lange.

Strahlentherap. 51:119, 1934.

Four properties render cathode rays useful for therapy, even deep therapy: 1. Their well-defined range; 2. The maximal energy transformation at a certain depth; 3. Their immense biological activity; 4. The magnetic deflection. Very high voltage is required to make use of these properties. At 3 million volt the maximal range is 1.3 cm. in water or soft tissues. The intensity maximum occurs at one-fifth of the maximal range for 9 million volts; but for 1.7 million volts it shifts to one-third of the maximal range. A small condenser discharge apparatus was built for a potential of 2½ million volt.

Intravesical Explosions as a Complication of Transurethral Electroresection: Herman L. Kretschmer.

J. A. M. A. 103:15-1144 (Oct. 13) 1934.

Explosions occurred in two cases at the end of the 313th and 344th resections, respectively. The complication was recognized and the patients operated on immediately. Both patients made an uneventful recovery following surgical repair, one being for an intraperitoneal and the other for an extraperitoneal rupture.

In both cases there was a very small amount of bleeding. The author advises that great care should be exercised in removing frequently the gases from the bladder. If fragments are aspirated with a pump, thorough irrigation should be done to remove the mixture of gases. Small intravesical explosions have been observed by many urologists.

Detachment of the Retina. K. Safar.

Arch. Ophthalmol. 11:933 (June) 1934.

The author's method consists of diathermic treatment which, with the animal experiments, dates back to the spring of 1930, and is therefore chronologically related to Gonin's method. The technic is simple and quick, with less trauma to the eye, and a large area may be operated on in one stage without injury to the tissues, if large multiple or concealed tears make it necessary. For this purpose, instead of Gonin's ignipuncture, multiple punctures of the sclera are made with diathermic needles in the area surrounding the tear, which cause coagulation of the underlying choroid. After removal of the sub-retinal fluid through the punctures, the retina comes in contact with the choroid, which reacts to the coagulation with an adhesive choroiditis, the proliferative layer of pigmented epithelium playing a large part in the formation of the chorioretinal adhesions which seals the retinal tear so that no more vitreous can pass under the retina to lift it up from the choroid. Thus the retinal detachment is healed. The punctures are made with electrodes of various shapes which are supplied with needles 1.8 mm. long.

For electrocoagulation the strength of current used is from 30 to 50 milliamperes with an electrode having one needle, from 80 to 100 milliamperes with an electrode having three needles, and from 150 to 200 milliamperes with an electrode having from five to eight needles. An apparatus having this strength of current with a spark frequency of 30,000 or 50,000 allows an easy perforation of the bulbar wall, with moderate coagulation. A lower frequency is not adequate, for it does not allow sufficiently easy perforation, but causes coagulation and drying out at the scleral surface. A high frequency facilitates the puncture greatly, but the coagulation is too slight, and its inflammatory effect may be insufficient.

Safar's method of operation, which he developed independently of Weve and Larsson, is distinguished from the methods of these surgeons by being perforating, on the one hand, and less damaging to the retina and vitreous body on the other.

Reattachment of the retina has been permanent in 57.5 per cent of forty eyes operated on without selection in 1932 and in 85 per cent of the first forty eyes operated on in 1933. Failures occurred in cases of old detachment, with a shrunken or contracted retina due to an operative scar, and in old people who could not be kept flat in bed for a sufficient length of time and who were inclined to bleed; however, hemorrhages into the vitreous are rarer with this method than with other methods.

Retinas with older detachments, with the formation of striae and a boundary area, could still be reattached; sometimes there was a surprising improvement in visual function. Generally, however, early operation is indicated, for the longer the de-

tachment persists, the less is the chance of reattachment and the regaining of useful function of the retina.

The Use of Artificial Sunlight for Illuminating Apparatus and the General Lighting of Examination Rooms. R. E. Wright.

Brit. J. Ophthalmol. 18:260 (May) 1934.

The so-called daylight lamps put on the market of recent years have very little resemblance to real bright daylight. Many are of a cold blue uncomfortable tint produced by placing a glass filter in front of an ordinary or gas-filled electric bulb. The artificial production of the softer yellow, more pleasing tint of direct sunshine has been attended by better results. The tint alone, of course, is not necessarily the only cause of discomfort, a more important one, being the flicker associated with the alternating current. An eminently suitable bulb is a special gas-filled 240 volt 500 watt Mazda bulb used in the Vita-Rays sun lamp. A comparison of the spectrum of this lamp and that of summer sunlight shows the close similarity of the properties of these sources of light, the range of rays being almost identical. These gas-filled tungsten filament bulbs require mounting in a reflector with a cooling device. They are expensive and have a life of 300-500 hours. This may be prolonged under certain circumstances. At the author's suggestion such a bulb was mounted in a special paraboloid reflector on a table lamp stand so that it can be placed anywhere in a room. When directed upwards in a small room it gives a flood light from the ceiling efficient and comfortable for general illumination without the source of light catching the eye. When directed at an object, such as test type, it gives for practical purposes, a parallel beam of calculable illuminating power at known distances.

Influence of High Tension High Frequency Currents on Blood Pressure. (Ueber den Einfluss hochgespannter Hochfrequenzströme auf den menschlichen Blutdruck.) R. F. v. Fischer.

Schweiz. med. Wchschr. 64:1013 (Nov.) 1934.

One single exposure of the human body with high potential and high frequency currents in 33 cases brought about a reduction of maximal pressure, but a slight one on minimal pressure. The decrease of maximal pressure was the more marked the higher the initial pressure was. When used repeatedly the effect was nearly the same as at the first time. When repeated regularly results were of longer duration. With abnormally low initial pressure a constant effect may bring about a raise of the maximal pressure, (200,000 volts and a frequency of about 800,000 — 1,000,000).

Sieve-Like Irradiation. (Siebstrahlung.) Wilhelm Haring.

Strahlenther. 51:154 (Sept.) 1934.

Acupuncture with radium needles constitutes a decidedly inhomogenous irradiation with utmost concentration and limitation of the radiative energy to the desired place. The source of radiation being placed most suitably, a considerable decrease of dos-

age is effected radially from the needle. Inhomogeneous penetration of the space is a characteristic feature and a most important factor of radium needle therapy, not only for gaining a high dosage but also for a good therapeutic total effect, careful treatment of the surroundings being secured by the convenient local arrangement of rays. The idea struck the author, that with x-rays, too, instead of using a clear full cone of light he might apply light needles closely arranged but yet strictly defined in the same way as a sprinkler would split a jet of water. The sieve for x-rays is a simple lead plate adequately perforated. By passing through it, full radiation becomes sieve-irradiation. Even dispersion by many x-ray needles affords simultaneous application of three times the previous dosage, also in large fields. The lead cribriform plate has 3 mm. thickness, 25 cm. length, 25 cm. width. A center field of 15 by 15 cm. is evenly perforated with closely arranged holes of a diameter of 3 mm. The solid margin of the plate (being 5 cm. wide) guards the patient against skin burns if over-radiation of the sieve field should occur. Fifty per cent of the incident deep irradiation passes through the sieve constituting sieve-irradiation while the lead screen of a 3 mm. thickness absorbs the remainder. Every x-ray needle is a bearer of unabated intensity, corresponding to three erythema doses at one time.

Sieve irradiation avoids the possibility to get accustomed to fractional dosage. Its biologic and therapeutic effect is still doubtful.

Effects of Short and Ultrashort Waves Upon Inorganic and Organic Combinations. (Ueber Einwirkung von Kurz- und Ultrakurzwellen auf anorganische und organische Verbindungen.) E. Hasché and H. Leunig. *Strahlenther.* 52:179 (Jan.) 1935.

Various inorganic and organic substances, viz.: blood serum, white of egg, starch, metal colloids, achromatic phosphorus and atmospheric air were tested for transformations in the short and ultrashort field within a wave range of 3.5 — 21 m. Though exposed for several hours with utmost intensity in fields of most modern high efficiency machines, in neither case was there noted any specific transformation of the substances as a possible influence of electric waves. Some influence — seemingly specific — on albumin of the body was evidently mere effect of heat.

Effect of Short Waves on the Course of Malta-Fever. (Die Wirkung der kurzen Wellen auf den Verlauf des Maltafiebers.) Guido Izar and Pasquale Moretti. *Klin. Wchschr.* 14:46 (Jan.) 1935.

Therapeutic attempts with short waves were suggested by experiences gained with their germicidal effect upon some strains of *brucella hominis*. The bacteria were destroyed by 4 m. and 8 m. waves while 15 m. waves did not exert any influence. Nine cases were treated, applications were made either to the spleen, with the patient in a lateral position, or to the spleen and the liver with the

patient in a dorsal position. Duration of treatment was from 15-20 minutes with daily exposures or with intervals of a few days. Results in six of the nine cases of Malta fever were absolutely beneficial; one case was successful though necessitating 17 exposures. Two of the cases proved negative. The authors believe in a certain relationship of the mechanism of short waves to vaccinothrapy and therapeutic fever. They maintain that their methods of treating Malta fever do not offer sufficient results for a definite conclusion.

Sterilization Through the Uterus. (Sterilisatio Multieris Uterina.) Ludwig Parllig.

Arch. f. Gynäk. 157:355, 1934.

The author offers a means of sterilization that he claims to be safe and easy. The cervix is dilated by laminaria. After a curettage the uterine cavity is dried by perhydrol and adrenaline. Then the fundal epithelium is destroyed by steam vapor delivered in double stop-cock tubes with protection to the cervix. The steam at 115 degrees F. for one to two minutes is a painless procedure. There is an increase in discharge following this procedure. The patient rapidly recovers after five to six days in bed. There is no atrophy but an increase in connective tissue. Case histories are referred to in the author's monograph.

Observations Upon the Effects of Heat and Sunlight in a Tropical Climate. F. Marsh.

J. Physiol. 70:38, 1930.

White and black rabbits exposed to tropical sun collapsed at 161 degrees and 146½ degrees F. respectively. The rectal temperature reached 112 degrees F. Observations on a fatal case of heat stroke in a Persian adult 24 hours before death showed in 100 cc. lactic acid in venous blood 100 mg., urea 84.7 mg., dextrose 80 mg., chlorides 436.7 mg. A depression of sweating occurred during 48 hours before death, attributed to the low content of chloride in the blood and tissues, in spite of the large amounts of salt and water administered. Sunstroke is caused by hyperthermia. There is no essential difference between sunstroke and heat stroke.

Effects of Air Contaminants on the Natural Light of Cities. H. B. Meller, and M. E. Warga.

Am. J. Pub. Health 23:217 (March) 1933.

Data are presented taken from 12 months continuous records of ultraviolet radiation in the region below 3,350 Å. The measurements were made in Pittsburgh with uranium photo-cells which actuated a Rentschler ultraviolet meter. The cell was rotated on a solar table so that its cathode was normal to the sun. The chief data are presented graphically to show the following: a comparison of ultraviolet radiation during a clear day in June and one in December; seasonal trends, hourly averages for clear and cloudy days with and without smoke films, the ultraviolet radiation averaged for every hour of each

month expressed as percentage of the maximum intensity, which exists on a June day. The paper is a progress report and not a close analysis. Further studies will appear in subsequent publications.

The Nature of Photophobia. James E. Lebensohn.

Arch. Ophthalmol. 12:380 (Sept.) 1934.

With local vasodilatation as a prerequisite factor, the interplay of light, oculomotor function and sensation is necessary to evoke the pain of photophobia; blepharospasm and lacrimation result secondarily from the disturbance in sensation. That the blinking reflex is not an essential factor in the causation of photophobia is indicated by the following evidence: (a) In facial paralysis with keratitis lagophthalmos, the photophobia presents the usual characteristics. (b) In surgical cases photophobia continues after paralysis of the orbicularis muscle and is not abolished until after the retrobulbar injection takes effect. (c) In phlyctenulosis, the blepharospastic syndrome continues in complete darkness.

The fact that photophobia is much greater with the direct than with the consensual reflex probably indicates that a fifth factor is to be considered possibly in the nature of a direct local response to light, either metabolic (Wilbrand) or vasomotor (Reed).

Photophobia is only a symptom, and the treatment of photophobia is best accomplished by the cure of the underlying disorder. When cyclopegics do not give complete relief, sedatives that tend to reduce trigeminal irritability, such as amidopyrine, acetylsalicylic acid and acetphenetidin, or the inhalation of trichlorethylene should be of help. In stubborn cases the occasional instillation of a concentrated solution of epinephrine is advised (synthetic epinephrine, from 1 to 2 per cent). Tablets of synthetic epinephrine are available, one of which dissolved in 0.1 cc. of water yields a 1 per cent solution.

Modern Methods of Treatment in Ophthalmology. Stewart Duke-Elder.

Practitioner, 131:466 (Oct.) 1933.

In corneal ulcers the value of radiation with ultraviolet light should not be forgotten. Ulcers of practically every type respond well, but it is in the more severe, the chronic, and the recurrent forms that the treatment is seen to the best advantage: in hypopyon ulcers for example, a greater chance of recovery is offered than can be expected from cauterization, with, at the same time, less permanent damage to the cornea. Acute and recurrent phlyctenular ulcers also provide a very suitable field for radiational

treatment associated with efficient diet and hygiene. Radiation of the cornea, of course, which does not involve damage to other structures of the eye, and which therefore necessitates the employment of a localized and finely focused beam of light, calls for special apparatus and technic.

Galvanic Skin Reflex and Blood Pressure Reactions in Psychotic States: Reactions to Sensory, Indifferent, Ideational and Ideational Stimuli. Chester W. Darrow and Alfred P. Solomon.

Arch. Neurol. & Psychiat. 32:273 (Aug.) 1934.

Patients manifesting certain psychotic mechanisms have been found to differ from normal persons, and from one another in prevailing electrical skin resistance levels and in physiologic reactions to certain stimuli. The differences have appeared sufficiently significant to justify presentation of the available data in fifty cases. The galvanic skin reflex (sometimes called "psychogalvanic" reflex) when recorded with an appreciable external potential is a measure of the permeability of the skin to the passage of an electric current. It is a function of the resistance and of the polarization of the tissues, especially those of the sweat glands. The same change in permeability of the tissue which permits the secretion of sweat also permits the passing of the ions carrying the electric current, and therefore accounts for the relation between the galvanic reaction and sweat secretion. The significance of the electrical changes recorded in this test may best appear by keeping in mind the relation to sweat secretion. From this study the following conclusions were arrived at.

1. Both small changes in blood pressure and small galvanic skin reflex reactions tend to be associated with impairment of the physiologic functions of the body.

2. Small blood pressure reactions to crucial ideational stimuli together with small galvanic reactions to all forms of ideational and to sensory stimuli tend to be associated with lack of "contact with reality."

3. The combination of small galvanic reactions to ideational stimuli with large blood pressure reactions to these stimuli tends to be associated with irritability and related manifestations.

4. A relation appears to exist between a large amount of free energy (or anxiety) and low electrical skin resistance and between a small amount of free energy and high electrical skin resistance.

5. The nature of the stimulus used, including its emotional value, and the physiologic and emotional state of the patient at the time of the test are essential considerations in the interpretation of the galvanic skin reflex and blood pressure reactions in clinical studies.